



**Gerencia de Producción**

**GP 01/18**

Santiago, 21 de febrero 2018

**ANT:** Reunión de Asistencia al Cumplimiento día 9 de febrero del presente, en el marco del Proceso de Autodenuncia de Enaex Servicios S.A. Planta Río Loa, ubicada en Calama

**MAT:** Responde a requerimiento de información establecido en dicha reunión

**PARA:** SRA. MARIE CLAUDE PLUMER BODIN,  
JEFE DIVISIÓN DE SANCIÓN Y CUMPLIMIENTO, SUPERINTENDENCIA DE MEDIO AMBIENTE

**AT:** JOHANA CANCINO PEREIRA  
ABOGADO DIVISIÓN DE SANCIÓN Y CUMPLIMIENTO, SUPERINTENDENCIA DE MEDIO AMBIENTE, REGIÓN METROPOLITANA

**DE:** ALEJANDRO CASTILLO HAMATI  
FIRMA POR MANDATO ESPECIAL OTORGADO POR REPRESENTANTE LEGAL, ENAEX SERVICIOS S.A

Estimada Sra. Marie Claude:

**ENAEX SERVICIOS S.A. EVACÚA PROPUESTA COMPLEMENTARIA A SUS ESCRITOS DE FECHAS 10 DE ABRIL Y 6 DE JUNIO DE 2017, PRESENTANDO ANTECEDENTES ADICIONALES PARA MEJOR RESOLVER, CON EL OBJETIVO DE QUE LA DIVISIÓN DE SANCIÓN Y CUMPLIMIENTO DE LA SUPERINTENDENCIA DEL MEDIO AMBIENTE DETERMINE CÓMO PROVEER LA AUTODENUNCIA DE LA PLANTA DENSAC (PLANTA RÍO LOA) DE OPERACIÓN DEL REGULADO**

Edmundo Gonzalo Jiménez Gallardo, RUT de persona natural [REDACTED], y en Representación Legal de la Empresa ENAEX SERVICIOS S.A, RUT 76.041.871-4, ésta domiciliada legalmente en Calle El Trovador No 4253, Comuna de Las Condes, RM de Santiago, responde en tiempo y forma al requerimiento a la Empresa, por parte de la División de Sanción y Cumplimiento (DSC, en adelante) de la Superintendencia del Medio Ambiente (SMA, en adelante), derivado de la segunda Reunión de Asistencia al Cumplimiento (por virtud del Artículo 3u de la LO-SMA).

El plazo para evacuar el requerimiento de escrito de presentación de propuesta y, con ello, de acreditar lo que se pide y requiere, por parte del Órgano Fiscalizador Ambiental, vence el día 23 de febrero de 2018.

La propuesta exigida reviste la forma de un "Complemento de Antecedentes Adicionales a los Requerimientos Previos de Información Complementaria para Proveer Autodenuncia", dictados por la SMA (DSC), a través de sendos Actos Administrativos del organismo (a saber, Resolución Exenta D.S.C. No 000401, de 5 de mayo de 2017 y Resolución Exenta D.S.C. No 000905, de 14 de agosto de 2017); lo anterior, en orden a que pueda la Autoridad resolver sobre dictar Resolución que provea la Autodenuncia.

Según se planteó en la Reunión de Asistencia al Cumplimiento, con la DSC de la SMA, la Propuesta que acá se perfecciona, destinada con el fin ulterior de disminuir el volumen o la capacidad de almacenamiento de la (s) sustancia (s) que son objeto del control y análisis por el SEIA, tiene por objetivo no ser la Planta autodenunciada, normativamente susceptible de ingreso por Letra ñ.4, artículo 3 del Decreto Supremo N° 40 al SEIA (con causal normativa de ingreso), toda vez que con la disminución del volumen almacenado y su respectiva capacidad, libera temporalmente a la Planta de ser susceptible de ingreso por tipología.

Con lo anterior se cumple un doble propósito: (1) la actividad en sí, deja de ser temporalmente susceptible de permisología ambiental, al menos por RCA, y (2) se pone fin inmediato a los hechos que constituyen "el tipo" de la infracción ambiental, con arreglo a lo exigido por el Artículo 41 inciso 3 de la LO-SMA, satisfaciendo, además, el requisito normativo exigido por la SMA, de cumplimiento de "idoneidad o conformidad" del Regulado con lo ordenado por el citado Artículo de la Ley aplicable.

Es menester agregar acá que, como este Regulado lo ha expresado en sus escritos anteriores, en el contexto de esta Autodenuncia, y sólo para efectos de reforzar el argumento sobre la introducción periódica de variables que han conformado y adicionado "externalidades positivas" al proceso mismo ejecutado por la Planta DENSAC, que en la evolución de dicho proceso, esta Planta actual constituye una "mejora ambiental sustancial" respecto de aquella que le precediera operacionalmente y que fuera (operara) anterior a la entrada en vigencia, como instrumento vinculante, del SEIA (abril de 1997). Además reforzar que ésta no produce impactos ambientales establecidos en el artículo 11 de la Ley N°19.300 sobre Bases Generales del Medio Ambiente.

Declaramos ante la Autoridad que, tal como se ha observado en sus escritos y presentaciones previos, toda la información acá proporcionada, por el Regulado, es PRECISA (inequívoca y detallada), VERÍDICA (transparente y consistente) y COMPROBABLE (verificable y empírica).

#### **COMPONENTES TÉCNICOS QUE FORMAN PARTE DE LA PROPUESTA REQUERIDA:**



Proceso de Autodenuncia "Operación Planta DENSAC"  
PLANTA RÍO LOA, ENAEX SERVICIOS S.A.

POR TANTO,  
Y en razón de todo lo antes expuesto, RUEGO RESPETUOSAMENTE a la Autoridad (DSC de la SMA) que se tenga por acogida la presente Propuesta, que constituye, según ordenado por el citado organismo, un "Complemento de Antecedentes Adicionales a los Requerimientos Previos de Información Complementaria para Proveer Autodenuncia", dictados por la SMA (DSC), a través de sendos Actos Administrativos del organismo (a saber, Resolución Exenta D.S.C. No 000401, de 5 de mayo de 2017 y Resolución Exenta D.S.C. No 000905. De 14 de agosto de 2017); lo anterior, en orden a que pueda la Autoridad mejor resolver en la materia en cuestión.

**ALEJANDRO HERNÁN CASTILLO HAMATI**

(RUT [REDACTED])

(Firma por Mandato Especial, otorgado por Representante Legal, acompañado en Anexo D)  
ENAEX SERVICIOS S.A.



## COMPLEMENTO DE ANTECEDENTES

*ACTIVIDAD:*

*AUTODENUNCIA "OPERACIÓN PLANTA  
DENSAC"*

ENAEX SERVICIOS S.A.  
PLANTA RÍO LOA

FEBRERO 2018

CALAMA



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## COMPONENTES TÉCNICOS QUE FORMAN PARTE DE LA PROPUESTA REQUERIDA.

### 1) Propuesta de cumplimiento alternativo hasta la obtención de Resolución de Calificación Ambiental Aprobatoria

Con fecha 10 de abril del 2017, Enaex Servicios S.A. Planta Río Loa, presenta carta para someterse a proceso de Autodenuncia frente a la DSC de la SMA, acogiendo al artículo 41 de la LO-SMA.

Durante la primera contestación realizada con fecha 6 de junio de 2017, en respuesta a la Resolución Exenta D.S.C. No. 000401 de 5 de mayo del mismo año, se indicó que los estanques utilizados para el almacenamiento de sustancias corrosivas para operación de Planta DENSAC, son los siguientes:

**Tabla 1.** Estanques declarados en Primera Contestación de Enaex a SMA con fecha 6 de junio de 2017

Producto	T	Capacidad (Kg)
HNO <sub>3</sub>	102 A	53.000
HNO <sub>3</sub>	102 B	53.000
HNO <sub>3</sub>	38 A	40.000
HNO <sub>3</sub>	38 B	39.000
HNO <sub>3</sub>	39	60.000
HNO <sub>3</sub>	24	45.000
<b>TOTAL</b>		<b>290.000</b>

En la Tabla 1. Estanques declarados en Primera Contestación de Enaex a SMA con fecha 6 de junio de 2017, se centra el hecho constitutivo de infracción a LO-SMA, debido a que la capacidad de almacenamiento total de la unidad es de 290.000 kilogramos, debiendo someterse al Sistema de Evaluación de Impacto Ambiental SEA, previo a su construcción y funcionamiento.

La propuesta de Enaex Servicios S.A. para cesar la infracción, consta de disminuir la capacidad de almacenamiento de las sustancias en comento, por debajo de lo establecido en la letra ñ.4 del artículo 3 del Decreto Supremo N°40 del Reglamento del Sistema de Evaluación de Impacto Ambiental, se mantendrán los siguientes estanques en operación:

**Tabla 2.** Estanques que se mantendrán en operación

Producto	T	Capacidad (Kg)
HNO <sub>3</sub>	102 A	53.000
HNO <sub>3</sub>	38 A	40.000
H <sub>2</sub> SO <sub>4</sub>	21	17.000
<b>TOTAL</b>		<b>110.000</b>

Los cuales suman una capacidad de almacenamiento de 110.000 kilogramos, bajo lo establecido en el instrumento legal mencionado en párrafo anterior.

El estanque 21 pertenece a otro proceso ajeno al autodenunciado, a una unidad de almacenamiento que no corresponde a unidad DENSAC, la cual ha sido habilitada para contener ácido sulfúrico con una capacidad de 17.000 kilogramos.

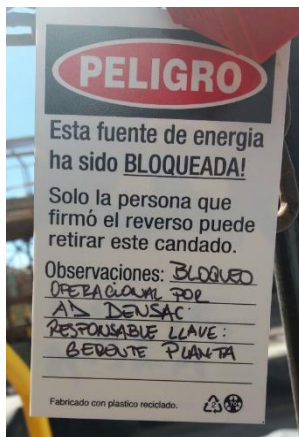
Los estanques que se muestran en la siguiente tabla, serán bloqueados para evitar su uso.

**Tabla 3.** Estanques deshabilitados para almacenamiento y bloqueados

Producto	T	Capacidad (Kg)
HNO <sub>3</sub>	102 B	53.000
HNO <sub>3</sub>	38 B	39.000
HNO <sub>3</sub>	39	60.000
HNO <sub>3</sub>	24	45.000

A continuación se adjuntan fotografías que evidencian el bloqueo operacional en comento, el cual consiste en un dispositivo físico con candado que inhabilita la operación de la válvula, el cual se encuentra identificado con una tarjeta indicando la prohibición de su uso, siendo el responsable de llave, Gerente de Planta.

**Ilustración 1.** Modelo Tarjeta Bloqueo Indicando como responsable a Gerente de Planta



**Ilustración 2** Registro Fotográfico de Bloqueo a Estanque 102 B de Capacidad 53.000 kg, que almacena HNO<sub>3</sub> al 60%







**Ilustraciones 3** Registro Fotográfico de Bloqueo a Estanque 38 B de Capacidad 39.000 kg, que almacena HNO<sub>3</sub> al 99%





**Ilustraciones 4** Registro Fotográfico de Bloqueo a Estanque 39 de Capacidad 60.000 kg, que almacena HNO<sub>3</sub> al 99%



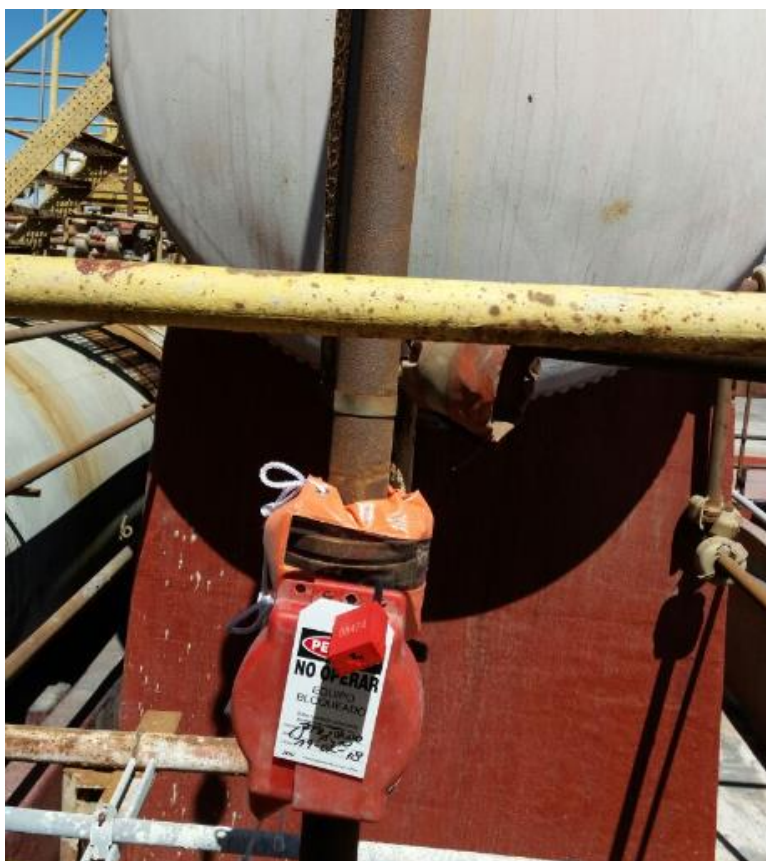




**Ilustraciones 5** Registro Fotográfico de Bloqueo a Estanque 24 de Capacidad 45.000 kg, que almacena HNO<sub>3</sub> al 60%







La operación de Planta DENSAC no se ve afectada por la capacidad de almacenamiento de 110.000 kilogramos, y seguirá operando con una capacidad de producción de 1.022 kg/hr de ácido nítrico y 55 kg/hr de ácido sulfúrico. Como se estableció anteriormente, solo se ve afectada la disponibilidad stock de emergencia que posee la planta que se encuentra para otros procesos.

Para asegurar la producción con capacidad de almacenamiento indicada anteriormente, es necesario aumentar la periodicidad de ingreso y salida de camiones con ácido sulfúrico y nítrico a Planta DENSAC (autorizada por RCA N°871/2013 "Transporte de Sustancias Peligrosas Enaex Servicios S.A.).

Según la primera contestación realizada por Enaex Servicios S.A., se establece lo siguiente:

La unidad DENSAC tiene como principal función concentrar ácido nítrico hasta un 98%. El proceso mediante el cual se concentra el ácido nítrico es el de destilación extractiva, que consiste en hacer pasar flujos de ácido nítrico al 60% proveniente del estanque 102 A y ácido sulfúrico al 89% proveniente de Nitrador Biazzi, retirando el agua del ácido nítrico y llevando su concentración desde un 60% hasta un 98%. Paralelamente, el ácido sulfúrico será almacenado en un estanque de 17.000 kilogramos de disponibilidad, el cual no fue considerado como unidad de almacenamiento de la Autodenuncia, debido a que no pertenece a operación DENSAC. Esta adecuación operacional fue necesaria para poder disponer de una capacidad de almacenamiento inferior a 120.000 kilogramos, según letra ñ.4 del artículo 3 del DS N° 40.

Con excepción de los estanques de almacenamiento, todos los equipos que participan en estos procesos están hechos de vidrio especial tipo pyrex (borosilicato), incluyendo los anillos raschig que se encuentran dentro de la columna de destilación, ya que es el material que mejor tolera altas concentraciones de ácido a altas temperaturas.

El ácido nítrico que se concentra en esta unidad llega a Planta en camiones desde Planta Prillex Mejillones (RCA vigente para el transporte de sustancias peligrosas para toda la Región de Antofagasta), además de efluentes provenientes desde nitradores, a una concentración del 60% y el ácido sulfúrico proviene de la planta Biazzi.

2) Análisis detallado de tipología global o múltiple (examen del Artículo 3 del RSEIA, para descartar, con este diagnóstico normativo ambiental, que la nueva modalidad operacional limitada o restringida, de la planta en Autodenuncia (del cumplimiento alternativo de las obligaciones del Regulado, por virtud del Artículo 41 de la LO-SMA), pueda constituir o ser causal de ingreso al SEIA (ingreso por letra) por una causal reglamentaria diferente a las contempladas en la DIA.

El proyecto debió haber ingresado al Sistema de Evaluación de Impacto Ambiental, dentro de la siguiente tipología, según lo establecido en el Artículo 3 del Decreto Supremo N°40 (RSEIA).

Letra ñ) Producción, almacenamiento, transporte, disposición o reutilización habituales de sustancias tóxicas, explosivas, radioactivas, inflamables, corrosivas o reactivas.

Específicamente la actividad ingresa por numeral ñ.4, el cual establece:

"Producción, disposición o reutilización de sustancias corrosivas o reactivas que se realice durante un semestre o más, y con una periodicidad mensual o mayor, en una cantidad igual o superior a ciento veinte mil kilogramos diarios (120.000 kg/día).

Capacidad de almacenamiento de sustancias corrosivas en una cantidad igual o superior a ciento veinte mil kilogramos (120.000 kg).

Se entenderá por sustancias corrosivas, aquellas señaladas en la Clase 8 de la NCh 382. Of 2013, o aquella que la reemplace"

De acuerdo a actividad de Planta DENSAC, produce una cantidad de ácido nítrico al 98% de 24.500 kg/día, para lo cual se requiere de 1.300 kg/día de ácido sulfúrico (25.800 kg/día total), cantidad nominal muy por debajo de los 120.000 kg/día que indica la norma como estándar para ser ingresado al Sistema de Evaluación de Impacto Ambiental (SEIA). Sin embargo, esta planta posee un sector de estanques con una capacidad de almacenamiento máxima de 290.000 kg (sumatoria de capacidades de almacenamiento de los estanques), lo cual excede los 120.000 kg establecidos en el RSEIA, indicado en el literal ñ.4. Sin embargo, para cumplir con el requisito establecido anteriormente, se ha modificado el almacenamiento de Planta DENSAC a una capacidad total de 110.000 kg, para cesar de infracción al Decreto Supremo N°40, del cual ha sido objeto la Autodenuncia de Enaex Servicios S.A., según lo establecido en carta enviada el día 10 de abril del 2017 a la División de Sanción y Cumplimiento de la Superintendencia de Medio Ambiente.

### 3) Aportación a la Autoridad de antecedentes de construcción de las piscinas DENSAC (capas impermeabilizantes, cámara de registro, facturas de compra materiales)

Planta DENSAC cuenta con dos piscinas de evaporación, con capacidad máxima de 462 m<sup>3</sup> cada una, ubicadas en el sector Noreste de la Torre como se ilustra en la siguiente imagen:

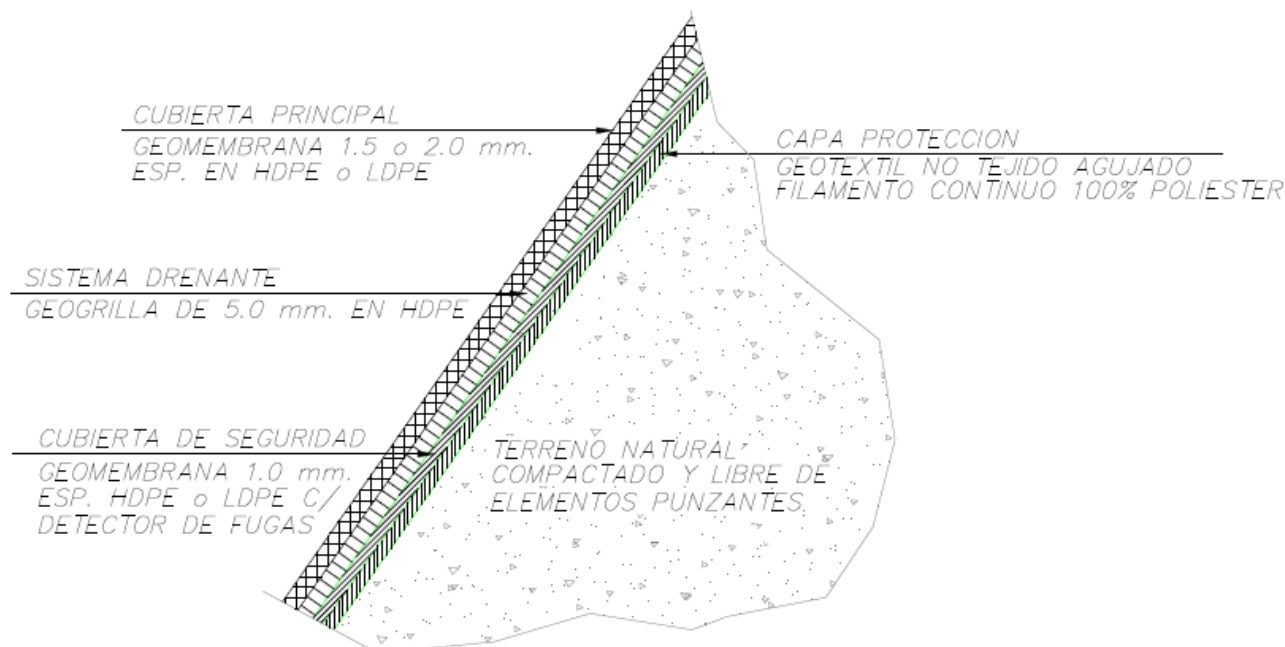
**Ilustración 6.** Imagen aérea de Piscinas de Evaporación DENSAC



Cada piscina tiene una capacidad de volumen de 462 m<sup>3</sup>, y 37,30 x 37,30 metros en su cara superior y 36,6 x 36,6 metros, en su cara inferior, con una altura operacional de 0,54 metros (altura de diseño total de 0,98 metros). La forma geométrica de las piscinas también es similar a un trapecio invertido.

Las dos piscinas de evaporación cuentan con un sistema de impermeabilización que evita la infiltración de RILes al suelo. Este sistema consiste en cuatro tipos de membranas dispuestas de la siguiente manera:

### Ilustración 7 Perfil de Sistema Impermeabilizante



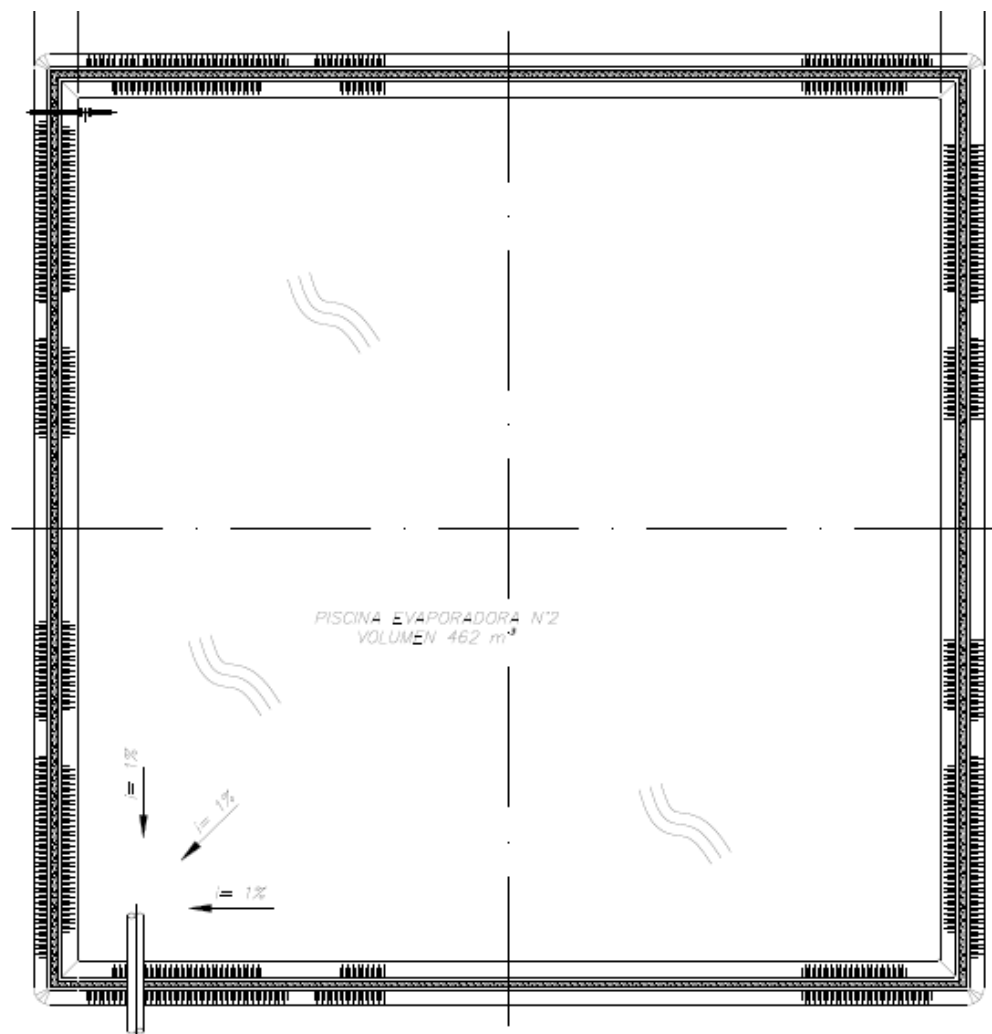
Como la imagen ilustra, el sistema impermeabilizante cuenta de 4 capas:

- **Cubierta principal:** compuesta por Geomembrana de 2 mm de espesor de HDPE;
- **Sistema Drenante:** compuesta por una Geogrilla de 5 mm de espesor en HDPE;
- **Cubierta de Seguridad:** compuesto por una geomembrana de HDPE de 1 mm de espesor, esencial en la detección de fugas; y
- **Capa de Protección:** geotextil no tejido agujado con filamento continuo 100% poliéster.

Además, estas piscinas cuentan con un sistema de contención y detección de filtración, ubicado en la esquina inferior derecha, como se muestra en la Ilustración 8 Plano piscina Evaporación, que consta de una pendiente de 1% guiada hacia un extremo del fondo de la piscina. En la eventualidad de una filtración, el RIL se canaliza hacia dicho lugar a través de la membrana que compone el Sistema Drenante, en este lugar existe un punto de registro que permite detectar mediante mediciones manuales si se han producido filtraciones.



Ilustración 8 Plano piscina Evaporación



Se acompaña el plano que indica el detalle de las piscinas de evaporación, como Anexo A

#### 4) Documentación técnica de torre de absorción, donde se exhiben y muestra memorias de cálculo, su descripción de funcionamiento e información de sus capacidades.

La torre de absorción es un equipo diseñado para captar los gases producidos en el proceso de concentración de ácidos, y recircularlos a la misma planta DENSAC como ácido diluido. Está provista de tres columnas de acero inoxidable 316L.

El grado 316L, tiene un más bajo contenido de carbono, lo cual aumenta la temperatura de resistencia a la corrosión intergranular, además de mejorar su soldabilidad. Mientras que la adición de Molibdeno le confiere una alta resistencia a la corrosión por pitting, no es templeable ni magnético y tiene gran resistencia a la acción corrosiva de reactivos químicos, en especial al ácido sulfúrico.

Las columnas cuentan con relleno del tipo anillo raschig plástico de bolas, lo que facilita la interacción de la fase líquida estacionaria y la fase móvil gaseosa.

El proceso de absorción comienza con la entrada de gases nitrosos a la unidad. Los gases provenientes de DENSAC son succionados hacia la torre de absorción por el ventilador V-1201.

A medida que los gases nitrosos se desplazan por las columnas de la torre, son absorbidos por una corriente de ácido diluido en cada una de las columnas.

En contracorriente se ingresa "agua fresca" a la primera torre (TK-1210), esta agua es recirculada por la bomba (P-1210) desde la Torre TK-1210 donde se absorben los gases nitrosos antes de ser enviados a la atmósfera (ANEXO C: Informe Monitoreo de Calidad del Aire, por Algoritmo SPA). En el conjunto de torres TK-1220 se recircula ácido diluido (concentración aproximada de 10%) con la bomba P-1220. En la torre TK-1230 se recircula el ácido diluido, entre 50% y 60% mediante bombeo (P-1230).

Todas las corrientes de recirculación son enfriadas con agua proveniente de intercambiadores tubulares IC-1210, IC-1220 e IC-1230 respectivamente.

El agua se desplaza por rebalse desde la Torre TK-1210 hacia TK-1220 y luego desde TK-1220 hacia TK-1230, de esta forma se mantiene el nivel de líquido en el sistema.

Con el objetivo de mejorar la remoción de  $\text{NO}_x$  presente, se habilitaron enfriadores de agua en cada recirculación de agua desde la base, se instaló una bomba centrífuga en el conjunto de torre 2, operando en forma independiente de la primera torre; se instaló un estanque estabilizador de nivel en el flujo de alimentación de la torre 1, las torres de absorción son automatizadas para su manejo y medición de parámetros desde sala de control DENSAC.

En el Anexo B se encuentra documentación de respaldo del proyecto de Torre de Absorción.

## 5) Análisis de aire (emisión de NOx) perimetral a la Planta DENSAC. Verificación de que no existe impacto al ambiente (recursos naturales) o a comunidad cercana alguna.

Enaex Servicios S.A. ha realizado análisis de calidad de aire en NOx, a través de empresa Algoritmo SPA, el cual se encuentra calificado como una Entidad Técnica de Calificación Ambiental, con código ETFA 015-01 bajo Resolución Exenta N° 178/2017

Planta DENSAC se encuentra emplazada en los vértices

**Tabla 4.** Coordenadas de vértices Planta DENSAC

Vértices	Coordenadas UTM Sistema de Referencia WGS 84	
	Norte (m)	Este (m)
V1	7.509.982	505.282
V2	7.509.976	505.291
V3	7.509.982	505.294
V4	7.509.987	505.285

La ubicación referencial se Planta DENSAC se ilustra a continuación:

**Ilustración 9.** Referencia ubicación Planta DENSAC



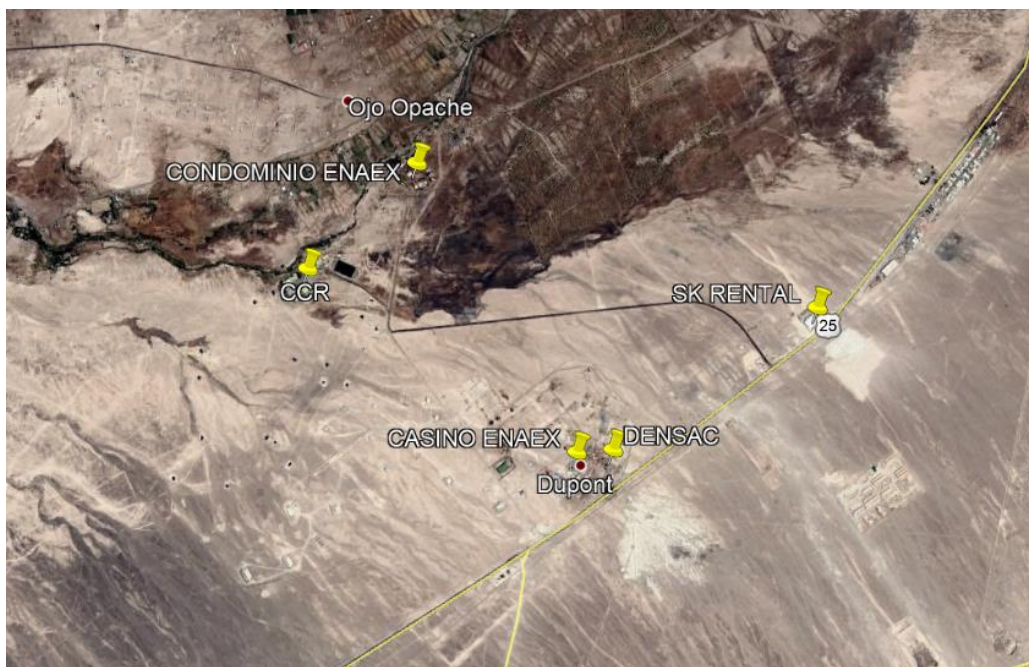
Es por ello que se identificaron 4 puntos de gran interés para evaluar la calidad de aire con respecto a NO<sub>x</sub>, en sectores aledaños a Planta DENSAC, siendo estos los siguientes:

**Tabla 5.** Coordenadas Puntos de Medición Calidad del Aire

Descripción	Coordenadas UTM Sistema de Referencia WGS 84	
	Norte (m)	Este (m)
Complejo Deportivo Radomiro Tomic	7.510.756	506.428
Condominio Enaex	7.511.455	504.225
Casino Enaex	7.509.954	505.111
SKC	7.510.756	506.428

Dichos puntos son ilustrados en referencia a Planta DENSAC en la siguiente imagen:

**Ilustración 10.** Ubicación referencial de puntos monitoreados



El resultado de la campaña de monitoreo demuestra que las emisiones NO<sub>2</sub> de Planta DENSAC se encuentran por debajo de la norma.

Se adjunta informe de Algoritmo sobre Estudio de Calidad de Aire en Anexo C de este documento.

## **ANEXO A**

### **DOCUMENTACIÓN TÉCNICA DE PISCINAS DE EVAPORACIÓN**

- Facturas de trabajo
- Planos de Piscinas de Evaporación



Fecha: \_\_\_\_\_ Recinto: \_\_\_\_\_  
 "El acuse de recibo que se declara en este acto, de acuerdo a lo dispuesto en la letra b) del Art. 4º, y la letra c) del Art. 5º de la Ley 19.983, acredita que la entrega de mercaderías o servicio (s) prestado (s) ha (n) Sido recibido (s)."



EMPRESA CERTIFICADA  
ISO9001: 2008, OHSAS18001:2007



CALAMA	11 / 06 / 2015		
SEÑORES : Enaex		TEL:	55 - 2367819
AT: Antar Aguad Poblete		FAX:	
REF. Revestimiento de piscinas de evaporación Enaex		CEL	94399213

De nuestra consideración:

En conformidad a lo solicitado, tenemos el agrado de hacerle llegar nuestra Cotización por el proyecto en referencia:

MORPUEA-COT- N 07 /2015						
Ítem	Descripción	Unid.	Cant.	Precio Unitario	Precio Total	Plazo Entrega
1	Construcción y revestimiento de piscina 37,3 X 37,3 Interno (2052 m2)	Unid	2	57.599.933	115.199.867	40 días hábiles
TOTAL NETO					115.199.867	

OBSERVACIONES	
1	Se considera la ejecución de todos los trabajos de obras civiles que incluyen el levantamiento topográfico de las piscinas, la excavación del terreno, el trabajo de nivelado de la base de la pila y el perfilado en 45° de los costados, la excavación de la zanja para la ubicación de la lámina para asegurarla, en el costado de la piscina.
2	Se considera la provisión y montaje de geotextil de 200 g/m2 sobre la superficie base de los trabajos de obras civiles.
3	Se considera la provisión de lámina de HDPE de 1 mm y su instalación sobre el geotextil, con las pruebas de calidad de canal de ensayo en soldaduras por cuña y cámara de vacío y/o pistola de chispas en soldaduras de extrusión.
4	Se considera la provisión y montaje de geonet 5 mm sobre la primera lámina de HDPE para la instalación del control de fugas.
4	Se considera la provisión de lámina de HDPE de 2 mm y su instalación sobre el geonet, con las pruebas de calidad de canal de ensayo en soldaduras por cuña y cámara de vacío y/o pistola de chispas en soldaduras de extrusión.
5	Se considera la provisión y montaje de lámina final de HDPE en 2 mm, con las pruebas de calidad de canal de ensayo sobre las uniones con máquina de cuña y con campanas de vacío y/o pistola de chispas, para las uniones de extrusión.
6	Se considera como aporte de Enaex, el agua potable requerida para trabajos de compactado de suelo y/o evitar contaminación excesiva en trabajos de excavación
7	Se considera que el material retirado como excedente se deja dentro de los límites de la planta de Enaex.
8	No se considera la instalación de comedores en las instalaciones de Enaex.

Condiciones generales

a.-	Valores no incluyen IVA. Facturación en pesos Chilenos.	
b.-	Lugar de Entrega :	Instalaciones Morpet Calama
c.-	Validez de la oferta :	30 días
d.-	Plazo de Entrega :	40 días hábiles



e.-	Condiciones de Pago :	Orden de compra
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Sin otro particular y atenta a cualquier consulta, se despide muy cordialmente de Usted  
MORPET Tecnologías Aplicadas S.A.

Razón Social: MORPET TECNOLOGIAS APLICADAS S.A

RUT: 96.562.320-5

Dirección: Av. Circunvalación #1156, Calama/Fono: 55-2367402

Cuenta corriente Banco de Chile N°162-49904-03

[www.morpet.cl](http://www.morpet.cl)

**Eduardo Pastén Hernández**

██████████  
████████████████████

FIRMA AUTORIZADA

**Condiciones Especiales:**

**Garantía del Producto:** MORPET garantiza la correcta aplicación del producto usado en el revestimiento, estableciendo un plazo de 6 meses a partir de la fecha de entrega del producto. MORPET. no se hará responsable de la falla del revestimiento, si este es sometido a condiciones diferentes a las indicadas en los datos de condiciones de borde entregadas por el mandante para el diseño del revestimiento y estipuladas en el protocolo de instalación.

**Demoras excusadas:** El vendedor no será responsable de las demoras en entregas o fallas para lograr la entregas, producidas directamente o indirectamente por causas ajenas al control del vendedor tales como: huelgas, mal tiempo, tormentas, inundaciones, fuego , escases de materias primas u otras causas mas allá del control del vendedor que lo restrinjan o inhabiliten para hacer la entrega del producto en el plazo acordado entre ambas partes.

**Lugar de entrega:** A menos que se indique lo contrario, todos los productos serán entregados en las instalaciones de Morpet Tecnologías aplicadas S.A..

**CONSTRUCCIÓN Y MONTAJE NEUTRALIZACIÓN DENSAC**

ITEM	DESCRIPCIÓN	CANT.	UNID.	P. UNIT	TOTAL \$
1.0	Generales				
1.1	Instalación de Faenas	2	mes	\$ 2,097.000	\$ 4.194.000
1.2	Movilización del personal	2	mes	\$ 3.000.000	\$ 6.000.000
1.3	Alimentación Personal	44	días	\$ 36.909	\$ 1.624.000
1.4	Traslado herramientas y materiales	1	GL	\$ 840.000	\$ 840.000
1.5	Cierro excavación y área de trabajo	1	GL	\$ 1.506.096	\$ 1.506.096
1.6	Retiro de excedentes	1	GL	\$ 800.000	\$ 800.000
1.8	Trazados y replanteo	1	GL	\$ 3.437.066	\$ 3.437.066
1.9	Elementos de Protección Personal	1	GL	\$ 3.166.274	\$ 3.166.274
1.10	Gastos Administrativos	1	GL	\$ 9.747.899	\$ 9.747.899
	<b>Subtotal</b>				<b>\$ 31.316.335</b>

ITEM	DESCRIPCIÓN	CANT.	UNID.	P. UNIT	TOTAL \$
2.0	Construcción Piscinas evaporación solar				
2.1	Piscinas				
2.1.1	Excavaciones y retiro de excedentes	4.474	m3	2842	\$ 12.716.791
2.1.2	Suministro Geomembrana 2.0 mm HDPE Doble capa	4500	m2	3.453	\$ 15.537.341
2.1.3	Suministro Geotextil No tejido agujado pilamento continuo 100% pollester	4500	m2	533	\$ 2.396.644
2.1.4	Suministro Geogrilla de 5 mm en HDPE	4500	m2	1.603	\$ 7.213.832
2.1.5	Suministro Geomembrana 1.0 mm ESP HDPE o LDPE C/DETECTOR DE FUGAS	4500	m2	2.067	\$ 9.300.045
2.1.6	Instalación Geomembrana 2.0 mm HDPE Doble capa	1	GL	8.490.348	\$ 8.490.348
2.1.7	Instalación Geotextil No tejido agujado pilamento continuo 100% pollester	1	GL	4.245.174	\$ 4.245.174
2.1.8	Instalación Geogrilla de 5 mm en HDPE	1	GL	2.122.587	\$ 2.122.587
2.1.9	Instalación Geomembrana 1.0 mm ESP HDPE o LDPE C/DETECTOR DE FUGAS	1	GL	6.367.761	\$ 6.367.761
2.1.10	Pruebas (Sparktester-iniciales- Destructivos)	1	GL	467.940	\$ 467.940

<b>Subtotal</b>				<b>\$ 68.858.462</b>
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<b>Subtotal Construcción y Montaje</b>				<b>\$ 100.173.797</b>
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<b>TOTAL COSTO DIRECTO</b>				<b>100.173.797</b>
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<b>UTILIDADES</b>			<b>%</b>	<b>15.026.070</b>
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<b>TOTAL NETO CONSTRUCCIÓN Y MONTAJE</b>				<b>115.199.867</b>
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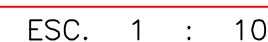
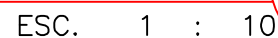


## ANEXO B

### DOCUMENTACIÓN TÉCNICA TORRE DE ABSORCIÓN

- Planos
- Facturas
- Fichas Técnicas Equipos

ESC. 1 : 30 — ARMADURA



## LISTADO DE MATERIALES

PESO CONJUNTO PARRILLA Kg= 15,70

TOTAL KG = 94,20

INGENIERIA Y  
CONSTRUCCION

ENAEX SERVICIOS

N° PLANO :

PROYECTO:	
-----------	--

INGENIERIA DE DETALLES  
TORRE DE ABSORCION

**DESCRIPCION:**

## PLANO DE FABRICACION PARRILLA

ESCALA  
INDICADAS

N° PLANO	
CLIENTE	

ENA-M-1074-01

ARCHIVO CAD

REV.

0

01	PROFESIONAL	NOMBRE	FECHA	FIRMA
CONTRATISTA	PROYECTO	E.CASTILLO G.	JULIO 2016	
	DIBUJO	E.CASTILLO G.	JULIO 2016	
	REVISO	O. CARALES C.	JULIO 2016	
	JEFE DE PROYECTO	O. CARALES C.	JULIO 2016	

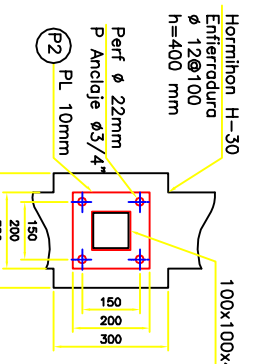
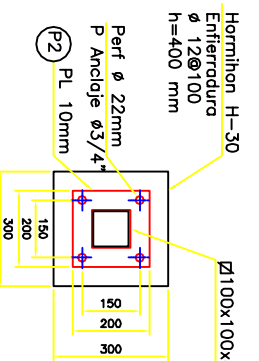
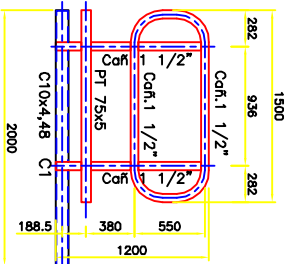
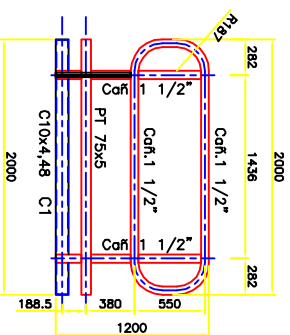
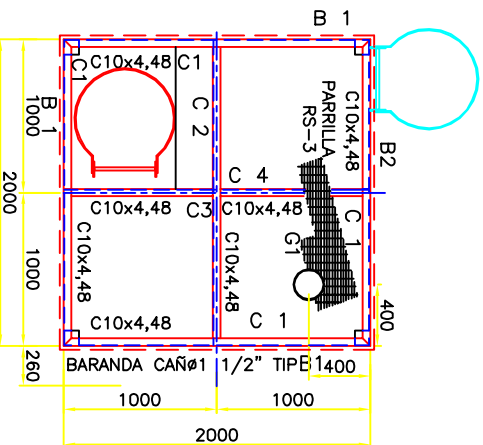
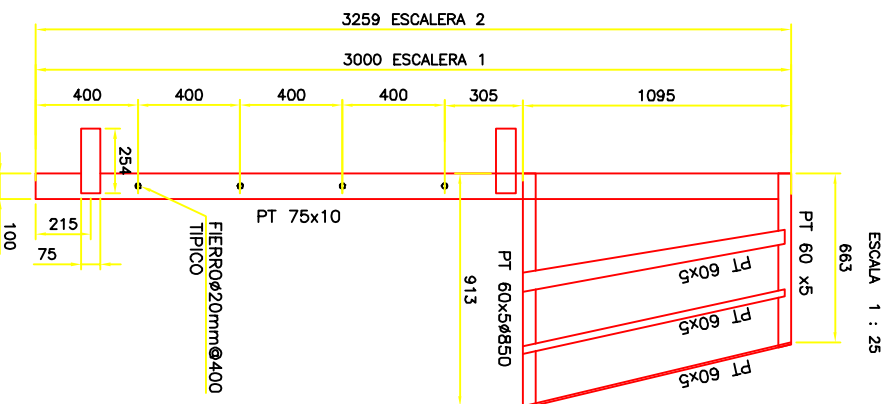
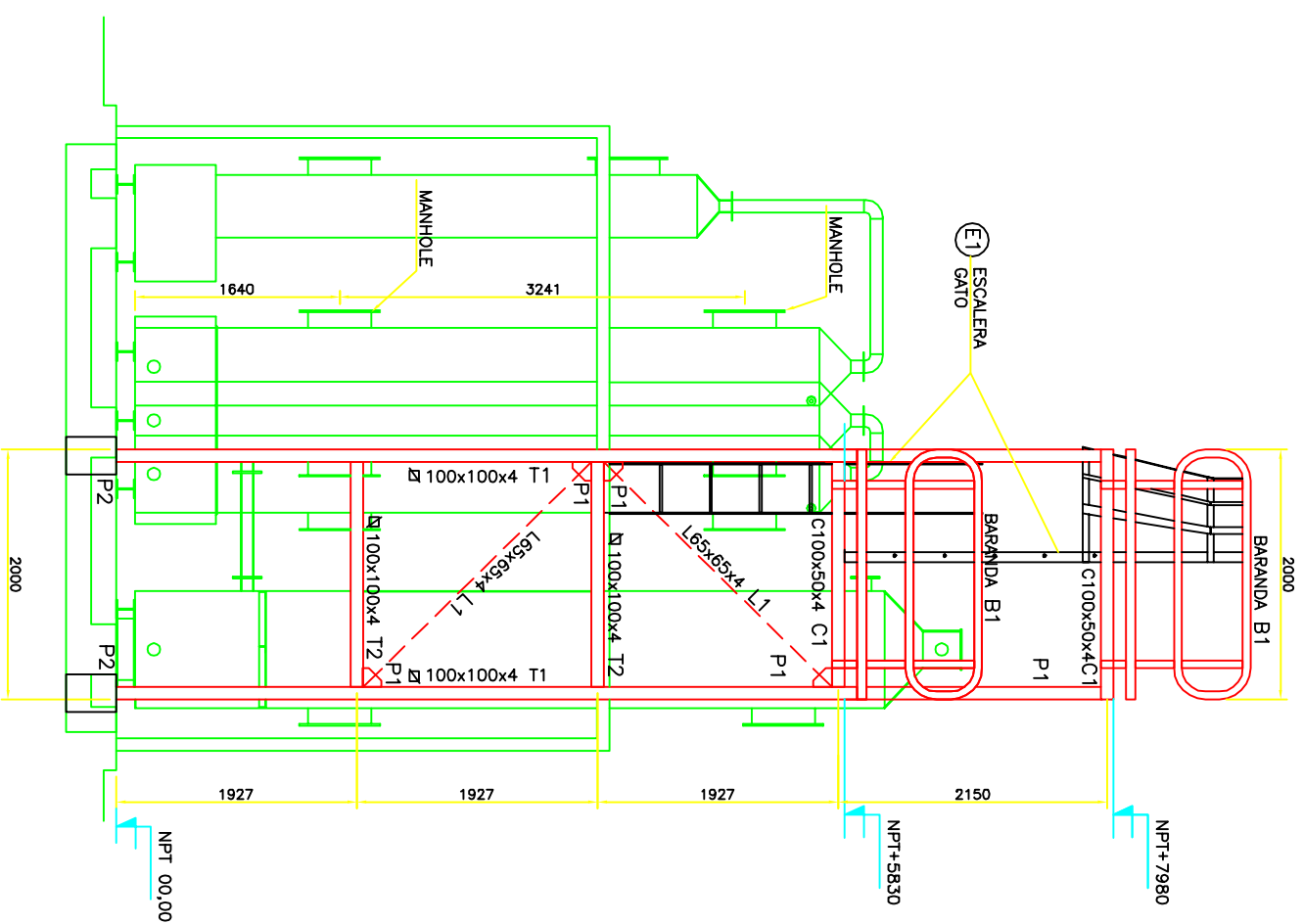
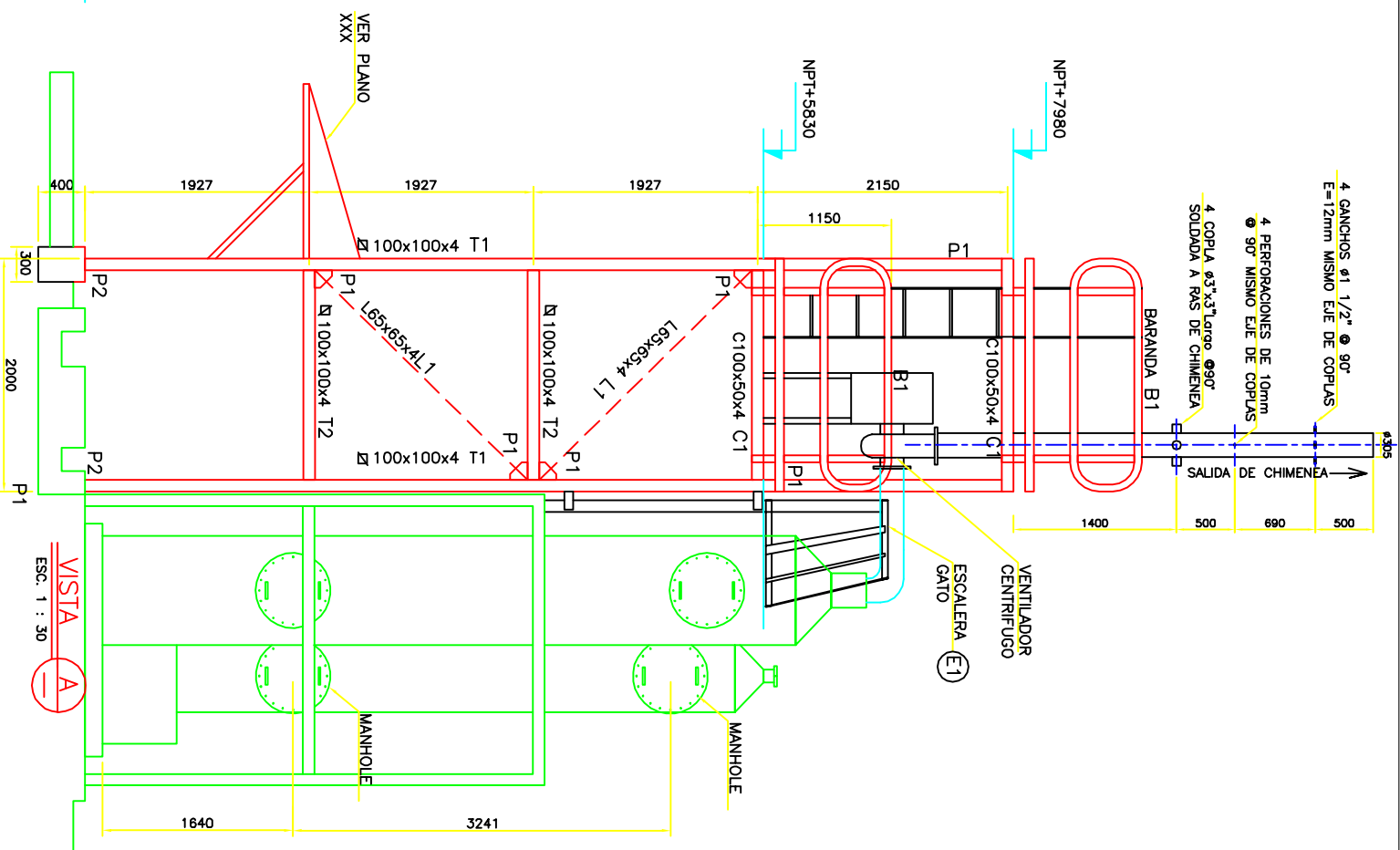
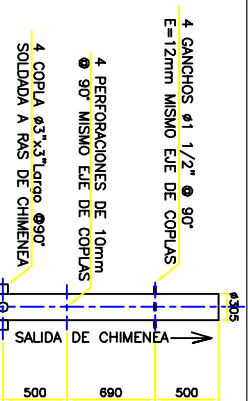
ENAE	APROBO	H. AGUAD	JULIO 2016	
	JEFE DE PROYECTO	H. AGUAD	JULIO 2016	

ESCALA		N° PLANO	ENA-M-1074-01	REV.	
INDICADAS		CLIENTE	ARCHIVO CAD	0	

REFERENCIAS		REVISIONES							1.- MEDIDAS EN mm, S.I.C.
									2.- MATERIAL A 316 L
									3.- VERIFICAR MEDIDAS
									EN TERRENO
									4.- SOLDADURA INOXIDABLE
									INOX CW (E310-16)
N° DE PLANO			N°	FECHA	DESCRIPCION	Rev.	Aprob.	Aprob. CDC	NOTAS

- 1.- MEDIDAS EN mm, S.I.C.
- 2.- MATERIAL A 316 L
- 3.- VERIFICAR MEDIDAS  
EN TERRENO
- 4.- SOLDADURA INOXIDABLE  
INOX CW (E310-16)





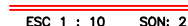
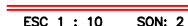
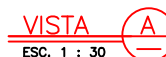
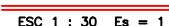
LISTADO DE MATERIALES								
ITEM	MCA.	DESCRIPCION	UNID	CANT	P. UNID	P. TOT	MATERIAL	OBSERVACION
1	C1	C 100x50x4	c/u	8	9,96	79,80	ASTM A36	
2	C2	C 100x50x4	c/u	2	8,92	17,80	ASTM A36	
3	C3	C 100x50x4	c/u	2	4,35	8,70	ASTM A36	
4	C4	C 100x50x4	c/u	2	4,57	9,14	ASTM A36	
5	1	Ø 100x1.00x4	c/u	4	90,00	360,00	ASTM A36	
6	12	Ø 100x1.00x4	c/u	8	21,77	174,16	ASTM A36	
7	L1	L 65x55x4	c/u	8	10,45	83,60	ASTM A36	
8	P1	PL. Bouset 10mm	c/u	16	1,00	16,00	ASTM A36	
9	P2	Placa Bous 10mm	c/u	4	3,15	12,60	ASTM A36	
10	G1	Perfille Plae RS 3	c/u	4	54,00	216,00	ASTM A36	
11	B1	BARAN.Cm.41 1/2"	c/u	4	36,30	254,10	ASTM A36	
12	B2	BARAN.Cm.41 1/2"	c/u	1	30,80	30,80	ASTM A36	
13	E1	ESCALERA DE CANTO	c/u	2	95,00	190,00	ASTM A36	
TOTAL KG = 1452,70								

[illegible]


Nº	FECHA	REVISIONES	REV.	APRO.	APRO. EMEX
					1.- MEDIDAS EN mm, S.I.C.
					3.- VERIFICAR MEDIDAS EN TERRENO
					2.- ACERO CARBONO ASTM A 36
					4.- SOLDADURA E7018 1/8 y 3/32
					5.- SOLDADURA FILET= ESPESOR PERFIL
					6.- TODAS LAS UNIONES SON SOLDADAS
					7.- SE OMITE SIMBOLOGIA DE SOLDADURA EN DIBUJO PARA NO SATURAR LAMINA

[illegible]





TOTAL KG =		950.00
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<div style="border: 1px solid black; width: 100px; height: 30px; margin: 0 auto;"></div> <b>INGENIERIA Y CONSTRUCCION</b>				<div style="border: 1px solid black; width: 100px; height: 30px; margin: 0 auto;"></div> <b>ENAEX SERVICIOS</b>			
				<b>PROYECTO:</b> <b>INGENIERIA DE DETALLES TORRE DE ABSORCION</b>			
<b>01</b>	<b>PROFESIONAL</b>	<b>NOMBRE</b>	<b>FECHA</b>	<b>FIRMA</b>	<b>DESCRIPCION:</b> <b>DISEÑO PLATAFORMA VENTILADOR</b>		
<b>CONTRATISTA</b>	PROYECTO	E.CASTILLO G.	JULIO 2016				
	DIBUJO	E.CASTILLO G.	JULIO 2016				
	REVISO	O. CARALES C.	JULIO 2016				
	JEFE DE PROYECTO	O. CARALES C.	JULIO 2016				
<b>ENAEX</b>	APROBO	H. AGUAD	JULIO 2016		<b>ESCALA</b>  <b>INDICADAS</b>		<b>N° PLANO CLIENTE</b>  <b>ARCHIVO CAD</b>
	JEFE DE PROYECTO	H. AGUAD	JULIO 2016				

ORIGINAL: CLIENTE



E-mail: ingenieria@ingeloa.cl  
construccion@ingeloa.cl  
rrhh@ingeloa.cl

**OSCAR ENRIQUE CARALES COPA**

SERVICIOS DE INGENIERÍA,  
Y CONSTRUCCIÓN

Hurtado de Mendoza 2787

Fono (55) 2845131 Cel.: 73968101

[www.ingeloa.cl](http://www.ingeloa.cl)

CALAMA

R.U.T.: 10. 226. 137 - 2

# FACTURA

N° 00025

Fecha: Agosto 26 de 2016

Señor(es): ENAEX SERVICIOS S.A.

Dirección: E/ TROVADOR N° 4253

Giro: FABRICACION DE EXPLOSIONES

Guia de Despacho:

S. I. I. CALAMA

Fecha Vigencia Emisión hasta 31 de Dic. 2016

RUT: 76.041.871-4

Comuna: LAS LANOES

Teléfono: (2) 22066752

Cond. de Venta: 30 DIAS

POR LO SIGUIENTE a: **OSCAR ENRIQUE CARALES COPA**

DEBE

[illegible]

SON: DOS MILLONES QUINIENTOS NOGUENTA  
Y UNO OCHOCIENTOS VEINTE Pesos

Nombre:

R. U. T.:

Firma:

**Fecha:**

Recinto:

NOTA: El acuse de recibo que se declara en este acto, de acuerdo a lo dispuesto en la letra b) del Art. 4° y la letra c) del Art. 5° de la Ley 19.983, acredita que la entrega de mercaderías o servicio(s) prestado(s) ha(n) sido recibido(s).

IMP FENIX - FONO 552 319475 - CALAMA

Neto

3

2. 178.000

% IVA

2

413.820

TOTAL

\$

2.59 1.820

S. E. ú O.

ORIGINAL: CLIENTE



OSCAR ENRIQUE CARALES COPA

SERVICIOS DE INGENIERÍA,  
Y CONSTRUCCIÓN

Hurtado de Mendoza 2787

E-mail: ingenieria@ingeloa.cl

construccion@ingeloa.cl

rrhh@ingeloa.cl

Fono (55) 2845131 Cel.: 73968101

www.ingeloa.cl

CALAMA

R.U.T.: 10.226.137 - 2

FACTURA

N° 00027

Fecha: DICIEMBRE 26 DE 2016

S.I.I. CALAMA  
Fecha Vigencia Emisión hasta 31 de Dic. 2016

Señor(es): ENAEX SERVICIOS S.A.

RUT: 76.041.871-4

Dirección: EL TROVADOR N° 4253

Comuna: LAS CONDÉS S/GO

Giro: FABRICA DE EXPLOSIVOS

Teléfono: \_\_\_\_\_

Guía de Despacho: \_\_\_\_\_

Cond. de Venta: \_\_\_\_\_

POR LO SIGUIENTE á: **OSCAR ENRIQUE CARALES COPA**

DEBE

CANT.	DETALLE	PRECIO UNITARIO	VALOR TOTAL
01	PROYECTO UPGRADES TORRE DE ABSORCIÓN (PEDIDO DE COMPRA N° 4500899341)	13.163.370	13.163.370
	trabajos adicionales torre de ABSORCIÓN (PEDIDO DE COMPRA N° 4800566823)	2.800.000	2.800.000
	MEMORIA DE CALCULO PLATAFORMA VENTILADOR (PEDIDO DE COMPRA N° 4800549202)	950.000	950.000
Cancelado, _____ de _____ de 20____		ENAEX S.A. 20 DIC 2016 RECIBIDO	

SON: VEINTE MILLONES CIENTO VEINTE Y  
SEIS MIL NOVECIENTOS DIEZ Pesos

Nombre: \_\_\_\_\_

R. U. T.: \_\_\_\_\_ Firma: \_\_\_\_\_

Fecha: \_\_\_\_\_ Recinto: \_\_\_\_\_

NOTA: El acuse de recibo que se declara en este acto, de acuerdo a lo dispuesto en la letra b) del Art. 4°, y la letra c) del Art. 5° de la Ley 19.983, acredita que la entrega de mercaderías o servicio(s) prestado(s) ha(n) sido recibido(s).

IMP. FENIX - FONO 552 319475 - CALAMA

Neto	\$	16.913.370
19 % IVA	\$	3.213.540
TOTAL	\$	20.126.910

S. E. ú O.

ORIGINAL: CLIENTE



E-mail: ingenieria@ingeloa.cl  
 construccion@ingeloa.cl  
 rrhh@ingeloa.cl

**OSCAR ENRIQUE CARALES COPA**

SERVICIOS DE INGENIERÍA,  
Y CONSTRUCCIÓN

Hurtado de Mendoza 2787

Fono (55) 2845131 Cel.: 73968101

[www.ingeloa.cl](http://www.ingeloa.cl)

CALAMA

R.U.T.: 10. 226. 137 - 2

FACTURA

N° 00026

Fecha: 01 DE OCTUBRE 2016

Señor(es): ENAEX SERVICIOS S.A.

Dirección: EL TROVADOR N° 4253

Giro: FABRICACION DE EXPLOSIVOS

Guía de Despacho: \_\_\_\_\_

S. I. I. CALAMA

Fecha Vigencia Emisión hasta 31 de Dic. 2016

RUT: 76.041.871-4

Comuna: LAS CONDÉS

Teléfono: (2) 22066752

Cond. de Venta: 30 Días

POR LO SIGUIENTE      a:      OSCAR ENRIQUE CARALES COPA

DEBE

[illegible]

SON: TREINTA Y SEIS MILLONES QUINIENTOS  
CINCUENTA MIL DOSCIENTOS NOVENTAY OCHO Pesos

Nombre:

R. U. T.:

Firma:

Fecha:

Recinto:

NOTA: El acuse de recibo que se declara en este acto, de acuerdo a lo dispuesto en la letra b) del Art. 4° y la letra c) del Art. 5° de la Ley 19.983, acredita que la entrega de mercaderías o servicio(s) prestado(s) ha(n) sido recibido(s).

IMP FENIX - FONDO 552 319475 - CALAMA

Neto

**S**

30.714.530

% IVA

3

5.835.761

TOTAL

\$

36.550.291

S. E. ú O.

ORIGINAL: CLIENTE



**OLIN S.A.**

DISTRIBUIDORA DE MATEIALES TECNICOS  
AV. VICUÑA MACKENNA Nº1621 - SANTIAGO  
SANTIAGO

**R.U.T.: 96.868.560-0**  
**FACTURA ELECTRONICA**  
**Nº 17710**

S.I.I. -

<b>Cliente</b>	: ENAEX SERVICIOS S.A.	<b>Emitido</b>	: 10-AGO-2016
<b>R.U.T.</b>	: 76.041.871-4	<b>Vence</b>	: 09-SEP-2016
<b>Giro</b>	: EXPLOSIVOS	<b>Pago</b>	:
<b>Dirección</b>	: EL TROVADOR N 4263 PISO 5		
<b>Comuna, Ciudad</b>	: LAS CONDES, SANTIAGO		
<b>Contacto</b>	:		

Código	Detalle	Cantidad	Unid.	P.Unitario	% Desc.	Total
179015423	REVISION 8 SENSORES TEMPERATURA DENSAC.	1,00	UNID	509.144,0000		509.144

Documento Ref.	Folio	Fecha	Razón Ref.	Dsc. ( %)	
ORDEN DE COMPRA	4800541556	10-AGO-2016			0
				<b>Neto \$</b>	509.144
				<b>I.V.A.(19 %)</b>	96.737
				<b>Retencion</b>	
				<b>Total \$</b>	605.881

<b>Observaciones</b>	<b>Transporte</b>
	<b>Patente</b> :
	<b>Dirección</b> :
	<b>Dest.</b> :

# Algoritmos y Mediciones Ambientales SPA

SERVICIOS DE INGENIERIA PRESTADOS POR EMPRESAS  
SEMINARIO 180 - PROVIDENCIA  
SANTIAGO

**R.U.T.: 77.007.600-5**  
**FACTURA ELECTRONICA**  
**N° 6711**

S.I.I. -

<b>Cliente</b>	:Enaex Servicios S.A	<b>Emitido</b>	: 18-ENE-2017
<b>R.U.T.</b>	: 76.041.871-4	<b>Vence</b>	: 18-FEB-2017
<b>Giro</b>	:Fabricacion de explosivos	<b>Pago</b>	:
<b>Dirección</b>	:El travador 4253 piso 5		
<b>Comuna, Ciudad</b>	:Las Condes, Santiago		
<b>Contacto</b>	:		

Código	Detalle	Cantidad	Unid.	P.Unitario	% Desc.	Total
590000004	Venta de (1) unidad de Monitoreo Continuo de Gases, Planta ENAEX Calama (Pago 70. Venta de (1) unidad de Monitoreo Continuo de Gases, Planta ENAEX Calama (Pago 70% Final).	0,70		56.313.933,5500		39.419.753

Documento Ref.	Folio	Fecha	Razón Ref.	Dsc. ( %)	
ORDEN DE COMPRA	4500838215	22-JUN-2016			0
				<b>Neto \$</b>	39.419.753
				<b>I.V.A.(19 %)</b>	7.489.753
				<b>Retencion</b>	
				<b>Total \$</b>	46.909.506

<b>Observaciones</b>	<b>Transporte</b>
	<b>Patente</b> :
	<b>Dirección</b> :
	<b>Dest.</b> :El travador 4253 piso 5

**Asesorias Algoritmos SPA**

SERVICIOS DE INGENIERIA PRESTADOS POR EMPRESAS  
SEMINARIO 180 - PROVIDENCIA  
SANTIAGO

**R.U.T.: 77.007.600-5**  
**FACTURA ELECTRONICA**  
**N° 6256**

S.I.I. -

<b>Cliente</b>	:Enaex Servicios S.A	<b>Emitido</b>	: 24-AGO-2016
<b>R.U.T.</b>	: 76.041.871-4	<b>Vence</b>	: 24-SEP-2016
<b>Giro</b>	:Fabricacion de explosivos	<b>Pago</b>	:
<b>Dirección</b>	:El travador 4253 piso 5		
<b>Comuna, Ciudad</b>	:Las Condes, Santiago		
<b>Contacto</b>	:		

Código	Detalle	Cantidad	Unid.	P.Unitario	% Desc.	Total
590000004	Venta de (1) unidad de Monitoreo Continuo de Gases, Planta ENAEX Calama (Anticip. Venta de (1) unidad de Monitoreo Continuo de Gases, Planta ENAEX Calama (Anticipo 30%).	0,30		57.231.597,7100		17.169.479

Documento Ref.	Folio	Fecha	Razón Ref.	Dsc. ( %)	
ORDEN DE COMPRA	4500838215	22-JUN-2016			0
				<b>Neto \$</b>	17.169.479
				<b>I.V.A.(19 %)</b>	3.262.201
				<b>Retencion</b>	
				<b>Total \$</b>	20.431.680

<b>Observaciones</b>	<b>Transporte</b>
	<b>Patente</b> :
	<b>Dirección</b> :El travador 4253 piso 5
	<b>Dest.</b>

**ASESORIAS INFORMATICAS Y  
AUTOMATIZACION OYANEDER S**

ASESORIAS EN INGENIERIA EJECUCION DE PROYECTOS  
ELECTRICOS INFORMATICOS AUTOMATIZ  
Obispo Arturo Espinoza Campos 2170 - MACUL  
SANTIAGO

**R.U.T.: 99.522.540-9**  
**FACTURA ELECTRONICA**  
**N° 2226**

S.I.I. -

<b>Cliete</b>	: ENAEX Servicios S.A.	<b>Emitido</b>	: 28-OCT-2016
<b>R.U.T.</b>	: 76.041.871-4	<b>Vence</b>	: 27-NOV-2016
<b>Giro</b>	: Venta y distribucion de explosivos	<b>Pago</b>	:
<b>Dirección</b>	: El Trovador # 4253 - Piso N 5		
<b>Comuna, Ciudad</b>	: LAS CONDES, SANTIAGO		
<b>Contacto</b>	: Sr. Jorge Chacana Fono: 8377600		

Código	Detalle	Cantidad	Unid.	P.Unitario	% Desc.	Total
GEN	CONFIGURACION SENSORES TORRE ABSORCION..	1,00	UN	2.951.145,0000		2.951.145

Documento Ref.	Folio	Fecha	Razón Ref.	Dsc. ( %)	
ORDEN DE COMPRA	4800547850	01-SEP-2016			0
				<b>Neto \$</b>	2.951.145
				<b>I.V.A.(19 %)</b>	560.718
				<b>Retencion</b>	
				<b>Total \$</b>	3.511.863

<b>Observaciones</b>	<b>Transporte</b>
	<b>Patente</b> :
	<b>Dirección</b> :
	<b>Dest.</b> :

**CONSTRUCCIONES Y SERVICIOS  
AFINES HECTOR NORMAN  
MATUS CUEVAS EMPRESA  
INDIVIDUAL DE  
RESPONSABILIDAD L**

SERVICIO DE CONSTRUCCION EN OBRAS MENORES  
ARRIENDO DE MAQUINARIA  
BRASILIA 2076, Villa/Pob. 23 - CALAMA

**R.U.T.: 76.425.349-3**  
**FACTURA ELECTRONICA**  
**N° 59**

S.I.I. -

<b>Cliente</b>	: ENAEX SERVICIOS S.A.	<b>Emitido</b>	: 17-NOV-2016
<b>R.U.T.</b>	: 76.041.871-4	<b>Vence</b>	:
<b>Giro</b>	: FABRICANTE DE EXPLOSIVOS	<b>Pago</b>	:
<b>Dirección</b>	: EL TROVADOR 4253		
<b>Comuna, Ciudad</b>	: LAS CONDES,		
<b>Contacto</b>	:		

Código	Detalle	Cantidad	Unid.	P.Unitario	% Desc.	Total
4800561283	PERNOS INOXIDABLES S/OC 4800561283.	1,00	UNID	2.663.072,0000		2.663.072
4800560970	ARRIENDO GRUA S/OC 4800560970.	1,00	UNID	3.762.000,0000		3.762.000
4800559777	MONTAJE DE REACTOR UV S/OC 4800559777.	1,00	UNID	1.306.448,0000		1.306.448

Documento Ref.	Folio	Fecha	Razón Ref.	Dsc. ( %)	
ORDEN DE COMPRA	4800561283	11-NOV-2016			0
ORDEN DE COMPRA	4800560970	10-NOV-2016		<b>Neto \$</b>	7.731.520
ORDEN DE COMPRA	4800559777	03-NOV-2016		<b>I.V.A.(19 %)</b>	1.468.989
				<b>Retencion</b>	
				<b>Total \$</b>	9.200.509

<b>Observaciones</b>	<b>Transporte</b>
	<b>Patente</b> :
	<b>Dirección</b> :
	<b>Dest.</b> :



**SOCIEDAD SERVICIOS A LA  
MINERIA T & S LIMITADA**

MANT.REP.CONST.ELECT.INSTRUMENTACION.MONTAJE  
MECANICO  
MADAME CURIE 2362 12 CENTRO - CALAMA  
CALAMA

**R.U.T.: 76.188.782-3**  
**FACTURA ELECTRONICA**  
**N° 13**

S.I.I. -

<b>Cliente</b>	: ENAEX SERVICIOS S.A.	<b>Emitido</b>	: 16-NOV-2016
<b>R.U.T.</b>	: 76.041.871-4	<b>Vence</b>	:
<b>Giro</b>	: FABRICACION DE EXPLOSIVOS Y PRODUCTOS DE	<b>Pago</b>	:
<b>Dirección</b>	: EL TROVADOR 4253 5		
<b>Comuna, Ciudad</b>	: LAS CONDES, STGO		
<b>Contacto</b>	:		

Código	Detalle	Cantidad	Unid.	P.Unitario	% Desc.	Total
	INSTALACION DE. CUADRICULADO M. DE TIERRA	1,00		8.329.780,0000		8.329.780

Documento Ref.	Folio	Fecha	Razón Ref.	Dsc. ( %)	
ORDEN DE COMPRA	4800560967	10-NOV-2016			0
				<b>Neto \$</b>	8.329.780
				<b>I.V.A.(19 %)</b>	1.582.658
				<b>Retencion</b>	
				<b>Total \$</b>	9.912.438

<b>Observaciones</b>	<b>Transporte</b>
	<b>Patente</b> :
	<b>Dirección</b> :
	<b>Dest.</b> :

## INFORME DE ENSAYO

Cliente / Customer

ASESORIAS ALGORITMOS SPA

SEMINARIO N° 180

N.° de análisis / Analysis No.: 1266-16

N.° de cilindro / Cylinder No.: 33512

N.° de orden / Order No.: CP190

Cilindro / Cylinder  
typeConexión de válvula  
/ Valve connectionPresión de llenado / Filling  
pressure

Volumen / Volume

Aluminio - 6 Lts

CGA 660

140 Bar

0.84 m3

Componente Component		Composición requerida Order	Resultado Result	Unidad Unit	Incerteza % Relativa Uncertainty % rel	Fecha Ensayo Test date
Oxido Nítrico	NO	1600.00	1590.00	ppm	+/- 0.50	29-09-2016
NOx	NOx	1600.00	1590.00	ppm	+/- 0.50	29-09-2016
Nitrógeno	N2	Balance				

Código - nombre producto / Code - Product name

: GE900091- NO 1001-4950 ppm, Bal N2

Método de preparación / Preparation method

: Gravimétrico conforme a ISO 6142

Metodo Analítico / Analytical Method

: Quimioluminiscencia

Nivel de confianza / Confidence level

: 95 %

Tolerancia de preparación / Blend tolerance

: 1 % relativa / % relative

Temperatura recomendada

: 0 a / to 20 °C

Recommended storage and usage temperature

Presión mínima de uso / Minimum pressure of use

: 3 Bar

Fecha de fabricación / Fabrication date

: 21-09-2016

Lugar de análisis / Analysis site

: Laboratorio Gases Especiales

Fecha emisión reporte / Report date

: 29-09-2016

Fecha expiración / Expiration date

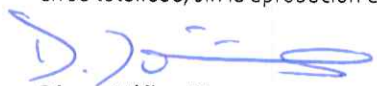
: 29-09-2018

Estandar de calibración / Calibration standar

N°	Tipo	Concentración	N° Cilindro
514	Guide:34:2009	NO: 2600.0ppm +/-0.5% NOx: 2600.0ppm +/-0.5%	313603

Comentarios / Comments :

Los resultados estan referidos únicamente a los ítemes ensayados. Este informe no puede ser reproducido, excepto en su totalidad, sin la aprobación escrita de Laboratorio de Gases Especiales, Linde Gas Chile S.A.

  
Diego Yáñez N.

Analista químico

Laboratorio de Gases Especiales  
Vicente Reyes #722, Maipú  
Santiago, ChileTeléfono: 800800242  
[callcenter.chile@linde.com](mailto:callcenter.chile@linde.com)  
Lenguaje válido oficial español

CL-PRO-002C

## INFORME DE ENSAYO

Cliente / Customer  
ASESORIAS ALGORITMOS SPA  
SEMINARIO N° 180

N.º de análisis / Analysis No.: 1224-16  
N.º de cilindro / Cylinder No.: P520954  
N.º de orden / Order No.: CP192

Cilindro / Cylinder type

Aluminio 6 Lts

Conexión de válvula  
/ Valve connection  
CGA 660

Presión de llenado / Filling  
pressure  
140 Bar

Volumen / Volume

0.8 m3

Componente Component		Composición requerida Order	Resultado Result	Unidad Unit	Incerteza % Relativa Uncertainty % rel	Fecha Ensayo Test date
Óxido Nitroso	N2O	1600	1634.90	ppm	+/- 2.00%	15-09-2016
Nitrógeno	N2	Balance				

Código - nombre producto / Code - Product name : GE100957 - N2O 100-5000ppm Bal N2  
Método de preparación / Preparation method : Gravimétrico conforme a ISO 6142  
Método Analítico / Analytical Method : Cromatografía Gaseosa PDD.

Nivel de confianza / Confidence level : 95 %  
Tolerancia de preparación / Blend tolerance : 2 % relativa / % relative  
Temperatura recomendada : 0 a / to 20 °C

Recommended storage and usage temperature : 3 Bar  
Presión mínima de uso / Minimum pressure of use : 14-09-2016  
Fecha de fabricación / Fabrication date : Laboratorio Gases Especiales  
Lugar de análisis / Analysis site : 15-09-2016  
Fecha emisión reporte / Report date : 15-09-2018  
Fecha expiración / Expiration date :  
Estandar de calibración / Calibration standar

Nº	Tipo	Concentración	Nº Cilindro
351	Patrón Primario	N2O: 1591.78 ppm +/- 1%	482807

Comentarios / Comments : Los resultados están referidos únicamente a los ítemes ensayados. Este informe no puede ser reproducido, excepto en su totalidad, sin la aprobación escrita de Laboratorio de Gases Especiales, Linde Gas Chile S.A.

  
Constanza Miranda  
Supervisor LGE

Laboratorio de Gases Especiales  
Vicente Reyes #722, Maipú  
Santiago, Chile

Teléfono: 800800242  
[callcenter.chile@linde.com](mailto:callcenter.chile@linde.com)  
Lenguaje válido oficial español

CL-PRO-002C



## INFORME DE ENSAYO

Cliente / Customer  
ASESORIAS ALGORITMOS SPA  
SEMINARIO N° 180

N.° de análisis / Analysis No.: 1210-16  
N.° de cilindro / Cylinder No.: 40885  
N.° de orden / Order No.: CP191

Cilindro / Cylinder  
type

Conexión de válvula  
/ Valve connection

Presión de llenado / Filling  
pressure

Volumen / Volume

Aluminio - 6 Lts

CGA 660

140 Bar

0.84 m3

Componente Component		Composición requerida Order	Resultado Result	Unidad Unit	Incerteza % Relativa Uncertainty % rel	Fecha Ensayo Test date
Dióxido de Carbono	CO2	8.00	7.89	%	+/- 0.50	13-09-2016
Oxígeno	O2	20.00	20.03	%	+/- 0.50	13-09-2016
Nitrógeno	N2	Balance				

Código - nombre producto / Code - Product name

Método de preparación / Preparation method

Método Analítico / Analytical Method

: GE101002- CO2/O2 ECOCAL 1-50% / 1-50%, Bal N2

: Gravimétrico conforme a ISO 6142

: IR, Paramagnético

Nivel de confianza / Confidence level

Tolerancia de preparación / Blend tolerance

Temperatura recomendada

Recommended storage and usage temperature

Presión mínima de uso / Minimum pressure of use

Fecha de fabricación / Fabrication date

Lugar de análisis / Analysis site

Fecha emisión reporte / Report date

Fecha expiración / Expiration date

Estandar de calibración / Calibration standard

: 95 %

: 1 % relativa / % relative

: 0 a / to 20 °C

: 3 Bar

: 12-09-2016

: Laboratorio Gases Especiales

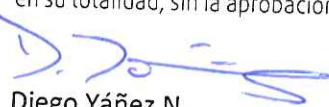
: 13-09-2016

: 13-09-2019

N°	Tipo	Concentración	N° Cilindro
325	Material de referencia (MR) Guide:34:2009	O2: 20.91% +/-0.5%	265050
508		CO2: 8.001% +/-0.5%	313594

Comentarios / Comments :

Los resultados están referidos únicamente a los ítemes ensayados. Este informe no puede ser reproducido, excepto en su totalidad, sin la aprobación escrita de Laboratorio de Gases Especiales, Linde Gas Chile S.A.

  
Diego Yáñez N.  
Analista químico

Laboratorio de Gases Especiales  
Vicente Reyes #722, Maipú  
Santiago, Chile

Teléfono: 800800242  
[callcenter.chile@linde.com](mailto:callcenter.chile@linde.com)  
Lenguaje válido oficial español



# NDIR TYPE INFRARED GAS ANALYZER (5-COMPONENT ANALYZER)

## DATA SHEET

**ZKJ**

This gas analyzer (ZKJ) is capable of measuring the concentrations of NO, SO<sub>2</sub>, CO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub>O and O<sub>2</sub> components in sample gas.

NO, SO<sub>2</sub>, CO<sub>2</sub>, CO, CH<sub>4</sub> and N<sub>2</sub>O are measured by non-dispersion infrared method (NDIR), while O<sub>2</sub> is measured by built-in type paramagnetic method sensor or external-mount type zirconia method sensor. A maximum of 5 components including O<sub>2</sub> (max. 4 components except for O<sub>2</sub> measurement) are simultaneously measurable.

The mass flow type twin detector of high sensitivity and reliability adopted in the infrared ray method detection block makes the measurement hardly affected by interfering components.

In addition, a microprocessor is built in and a large-size liquid crystal display is equipped for easier operation, higher accuracy and more functions.

Optimum as an analyzer unit of measurement system for combustion exhaust gas from refuse incinerator and boiler, or gas from different industrial furnaces.



## SPECIFICATIONS

### Standard Specifications

#### Principle of measurement:

NO, SO<sub>2</sub>, CO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub>O;

Non-dispersion infrared-ray absorption method

Single light source and double beams (double-beam system)

O<sub>2</sub> ; Paramagnetic O<sub>2</sub> sensor (built in) or zirconia O<sub>2</sub> sensor (externally installed)

#### Measurable gas components and measuring range:

	Minimum range	Maximum range
NO	0 – 50ppm	0 – 5000ppm
SO <sub>2</sub>	0 – 50ppm	0 – 10vol%
CO <sub>2</sub>	0 – 20ppm	0 – 100vol%
CO	0 – 50ppm	0 – 100vol%
CH <sub>4</sub>	0 – 200ppm	0 – 100vol%
N <sub>2</sub> O	0 – 200ppm	0 – 2000ppm
O <sub>2</sub> (built in)	0 – 5vol%	0 – 25vol%
O <sub>2</sub> (External Zirconia)	0 – 5vol%	0 – 25vol%

- Max. 5 components measurement including O<sub>2</sub>.

- Measuring range ratio ≤ 1:5 (O<sub>2</sub>)  
≤ 1:25 (except for O<sub>2</sub>)

- Measuring ranges are changeable between the specified minimum and maximum range  
Settable one range or two ranges

- When only N<sub>2</sub>O analyzer is used, make sure not to contain any components other than N<sub>2</sub>O.

Multicomponent analyzers including N<sub>2</sub>O analyzer + CO<sub>2</sub> analyzer are used for sludge incineration. In this case, the range of N<sub>2</sub>O is 0 to 200ppm/500ppm, and the range of CO<sub>2</sub> is 0 to 10%/20%.

\*For measurable components and possible combinations of measuring ranges, refer to Tables 1-(1) to (3).

## FEATURES

1. Measure five components including O<sub>2</sub> simultaneously and continuously  
Simultaneously and continuously measures up to four components out of NO, SO<sub>2</sub>, CO, CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, plus O<sub>2</sub>, or up to totally five components.
2. Hardly affected by interference by other gases  
The mass flow type twin detector of high sensitivity and reliability adopted makes the measurement hardly affected by interfering components, ensuring a stable operation.
3. Equipped with abundant functions  
O<sub>2</sub> conversion, average value computation, automatic calibration, one touch calibration, upper/lower limit alarm, remote measurement range changeover, range identification signal output, etc. incorporated can configure applications to match particular uses.
4. Easy-to-see large LCD unit  
The large LCD unit adopted allows observing easily the indication of all measured components and computation values.  
The interactive operation facilitates setting.
5. 19 inch rack mount structure  
The mainframe unitized to 19 inch rack type and electrical signal input/output terminal unit also unitized easily configure a gas analyzer system.
6. Maximum range ratio is 1 to 25  
Measuring ranges are changeable.
7. Drift +/-1% FS/week (more than 0 to 200ppm range)

**Measured value indication:**

- Digital indication in 4 digits  
(LCD with back light)
- Instantaneous value of each component
- Instantaneous value after O<sub>2</sub> conversion  
(only in NO, SO<sub>2</sub>, CO measurement with O<sub>2</sub>)
- Average value after O<sub>2</sub> conversion  
(only in NO, SO<sub>2</sub>, CO measurement with O<sub>2</sub>)
- O<sub>2</sub> average value

**Analog output signals:**

- \* Inputs/outputs of analog signals are possible by combining with the input/output terminal module.
- 4 to 20mA DC or 0 to 1V DC,  
non-isolated output ; 12 points max.  
max.load 550Ω. for 4 to 20 mA DC  
min.load 100kΩ. for 0 to 1V DC
- \* Refer to Table 2, for the channel No.  
of displayed values and analog output signals.

**Analog input signal:**

- For signal input from externally installed O<sub>2</sub> sensor.
- Signal requirement;
- (1) Signal from Fuji's Zirconia O<sub>2</sub> sensor (TYPE: ZFK7)
- (2) 0 to 1V DC from an O<sub>2</sub> sensor
- Input section is not isolated. This feature is effective when an O<sub>2</sub> sensor is not built in.
- (Depend on O<sub>2</sub> input signal, measured concentration indication and O<sub>2</sub> conversion.)

**Relay contact output:**

- 1a contact (250V AC/2A, resistive load)  
Instrument error, calibration error,  
range identification, auto calibration  
status, pump ON/OFF, peak alarm.
- 1c contact (250V AC/2A, resistive load  
selectable 6 outputs)  
High/Low limit alarm contact output.  
Power disconnection alarm.
- \* All relay contacts are isolated mutually and from the internal circuit.

**Contact input:**

- No-voltage contact (ON/0V, OFF/5V  
DC, 5mA flowing at ON)  
Remote range switch, auto calibration  
remote start, remote holding,  
average value resetting, pump ON/  
OFF
- Isolated from the internal circuit with  
photocoupler. Contact inputs are not  
isolated from one another.

**Transmission output:**

- Solenoid valve drive signal for automatic  
calibration.

**Power supply:**

- Transistor output (100mA or less)
- Voltage rating ; 100V to 240V AC
- Allowable range; 85V to 264V AC
- Frequency ; 50Hz/60Hz
- Power consumption; 250VA max.
- Inlet ; Conform to EN60320  
Protection Class 1

**Operating conditions:**

- Ambient temperature; -5°C to 45°C
- Ambient humidity ; 90% RH max.,  
non-condensing

**Storage conditions:**

- Ambient temperature; -20°C to 60°C
- Ambient humidity ; 100% RH max.,  
non-condensing

**Dimensions (H x W x D):**

- Analyzer main unit;  
177 x 483 x 600mm
- Input/output terminal module;  
164 x 318 x 55mm

**Mass:**

- Approx. 22 kg (only Analyzer)

**Finish color:**

- Front panel; Off-white (Munsell 10Y7.5/0.5  
or equivalent)
- Casing; Plating, Steel-blue (gray)

**Enclosure:**

- Steel casing, for indoor use

**Material of gas-contacting parts:**

- Gas inlet/outlet; SUS304
- Sample cell; SUS304, chloroprene rubber
- Infrared-ray transmitting window; CaF<sub>2</sub>
- O<sub>2</sub> sensor sample cell : SUS316
- Internal piping; Toaron, Teflon

**Gas inlet/outlet:** Rc<sup>1</sup>/<sub>4</sub> or NPT<sup>1</sup>/<sub>4</sub> internal thread**Purge gas flow rate:** 1L/min ( when required)

## Standard Functions

### Output signal holding:

Output signals are held during manual and auto calibrations by activation of holding (turning "ON" its setting).

The values to be held are the ones just before start calibration mode or setting value.

It is selectable.

Indication of instantaneous values will not be held.

### Remote output holding:

Output signal is held at the latest value or setting value by short-circuiting the remote output holding input terminals.

Holding is maintained while the terminals are short-circuited. Indication of instantaneous values will not be held.

### Switch ranges :

The switch ranges is available in manual, auto, and remote modes. Only preset switch method is effective.

**Manual:** Allows range to switch by key operation.

**Auto:** Allows range to switch from low to high range when 90%FS or more is available in the low range.

Allows range to switch from high to low range when 80%FS or less is available in the low range.

**Remote:** No-voltage contact input (for measurable components)

Allows range to switch via an external signal when remote range switch input is received.

When the contact input terminals for each component are short-circuited, the first range is selected, and it is switched to the second range when the terminals are open.

### Range identification signal:

The present measuring range is identified by a contact signal.

The contact output terminals for each component are short-circuited when the first range is selected, and when the second range is selected, the terminals are open.

### Auto calibration:

Auto calibration is carried out periodically at the preset cycle.

When a standard gas cylinder for calibration and a solenoid valve for opening/closing the gas flow line are prepared externally by the customer, calibration will be carried out with the solenoid valve drive contacts for zero calibration and each span calibration turned on/off sequentially at the set auto calibration timing.

#### Auto calibration cycle setting:

Auto calibration cycle is set.

Setting is variable within 1 to 99 hours (in increments of 1 hour) or 1 to 40 days (in increments of 1 day).

#### Gas flow time setting:

The time for flowing each calibration gas in auto calibration is set.

Settable within 60 to 900 seconds (in increments of 1 second)

### Auto calibration remote start:

Auto calibration is carried out only once according to an external input signal. Calibration sequence is settable in the same way as the general auto calibration.

Auto calibration is started by opening the auto calibration remote start input terminals after short-circuiting for 1.5 seconds or longer.

### Auto zero calibration:

Auto zero calibration is carried out periodically at the preset cycle.

This cycle is independent on "Auto calibration" cycle.

When zero calibration gas and solenoid valve for opening/closing the calibration gas flow line are prepared externally by the customer, zero calibration will be carried out with the solenoid valve drive contact for zero calibration turned on/off at the set auto zero calibration timing.

#### Auto zero calibration cycle setting:

Auto zero calibration cycle is set.

Setting is variable within 1 to 99 hours (in increments of 1 hour) or

Setting is variable within 1 to 40 days (in increments of 1 day)

#### Gas flow time setting:

The timing for flowing zero gas in auto zero calibration is set.

Settable 60 to 900 seconds (in increments of 1 second)

### High/Low limit alarm:

Alarm contact output turns on when measurement value reach to the preset high or low limit alarm value.

Contacts close when the channel value of each channel becomes larger than the high alarm limit value or smaller than the low alarm limit value.

### Instrument error contact output:

Contacts close at occurrence of analyzer error No. 1, 3 or 10.

### Calibration error contact output:

Contacts close at occurrence of manual or auto calibration error (any of errors No. 4 to 9).

### Auto calibration status contact outputs:

Contacts close during auto calibration.

### Pump ON/OFF contact output:

During measurement, this contact close. While calibration gas is flowing, this contact open. This contact is connected in power supply of pump, and stop the sample gas while calibration gas flowing.

### Optional Functions

**O<sub>2</sub> conversion:** Conversion of measured NO, SO<sub>2</sub> and CO gas concentrations into values at standard O<sub>2</sub> concentration

$$\text{Conversion formula: } C = \frac{21 - O_n}{21 - O_s} \times C_s$$

C : Sample gas concentration after O<sub>2</sub> conversion

C<sub>s</sub> : Measured concentration of sample gas

O<sub>s</sub> : Measured O<sub>2</sub> concentration  
(Limit settable, 1 to 20% O<sub>2</sub>)

O<sub>n</sub> : Standard O<sub>2</sub> concentration (value changeable by setting; 0 to 19% O<sub>2</sub>)

**Average value after O<sub>2</sub> conversion and O<sub>2</sub> average value calculation:** The result of O<sub>2</sub> conversion or instantaneous O<sub>2</sub> value can be outputted as an average value in the preset period of time.

Used for averaging is the moving average method in which sampling is carried out at intervals of 30 seconds.

(Output is updated every 30 seconds. It is the average value in the determined period of time just before the latest updating.)

Averaging time is settable within 1 to 59 minutes (in increments of 1 minute) or 1 to 4 hours (in increments of 1 hour).

**Average value resetting:**

The above-mentioned output of average value is started from the initial state by opening the average value resetting input terminals after short-circuiting for 1.5 seconds or longer.

Output is reset by short-circuiting and restarted by opening.

**CO concentration peak count alarm:**

(added only for CO/O<sub>2</sub> measurement)

Alarm output turns on according to the preset concentration and count.

Whenever the instantaneous value of CO exceeds the preset concentration value, count increments. If the count exceeds the preset value in one hour, the alarm contacts close.

**Communication function:**

RS-232C (9pins D-sub)

Half-duplex bit serial

Start-stop synchronization

Modbus™ protocol

Contents: Read/Wright parameters

Read measurement concentration and instrument status

Remark: When connecting via RS-485 interface, a RS-232C ↔ RS-485 converter should be used.

### Performance

**Repeatability** : ±0.5% of full scale

**Linearity** : ±1% of full scale

**Zero drift** : ±1% of full scale/week  
(±2% of full scale/week; range between 0 to 50ppm and 0 to 200ppm)  
(±2% of full scale/day; smaller than 0 to 50ppm range)

**Span drift** : ±2% of full scale/week  
(±2% of full scale/day; smaller than 0 to 50ppm range)

**Response time** :  
(for 90% FS response)

15 sec electrical response

Within 60 seconds including replacement time of sampling gas (when gas flow rate is 0.5L/min)

Gas replacement time depends on the number of measuring components, and measuring range

### Standard Requirements for Sample Gas

**Flow rate** : 0.5L / min ±0.2L / min

**Temperature** : 0 to 50°C

**Pressure** : 10 kPa or less (Gas outlet side should be open to the atmospheric air.)

**Dust** : 100µg/Nm<sup>3</sup> or less in particle size of 1µm or less

**Mist** : Unallowable

**Moisture** : Below a level where saturation occurs at 2°C (condensation unallowable).

**Corrosive component:**

1 ppm or less

**Standard gas for calibration:**

Zero gas ; Dry N<sub>2</sub>

Span gas ; Each sample gas having concentration 90 to 100% of its measuring range (recommended).  
Gas beyond concentration 100%FS is unusable.

In case a zirconia O<sub>2</sub> analyzer is installed externally and calibration is carried out on the same calibration gas line:

Zero gas ; Dry air or atmospheric air (provided without CO<sub>2</sub> sensor)

Span gas ; For other than O<sub>2</sub> measurement, each sample gas having concentration 90 to 100% of its measuring range.

For O<sub>2</sub> measurement, O<sub>2</sub> gas of 1 to 2 vol%.



### Installation Requirements

- Indoor use. (Select a place where the equipment does not receive direct sunshine, draft/rain or radiation from hot substances. If such a place cannot be found, a roof or cover should be prepared for protection.)
- Avoid a place where receives heavy vibration
- Select a place where atmospheric air is clean

### EC Directive Compliance

The product conforms to the requirements of the Low Voltage Directive 73/23/EEC and EMC directive 89/336/EEC (as amended by Directive 92/31/EEC), both as amended by Directive 93/68/EEC.

It conforms to following standards for product safety and electromagnetic compatibility ;

EN61010-1 : 2010 Safety requirements for electrical equipment for measurement, control and laboratory use.

"Installation Category II"

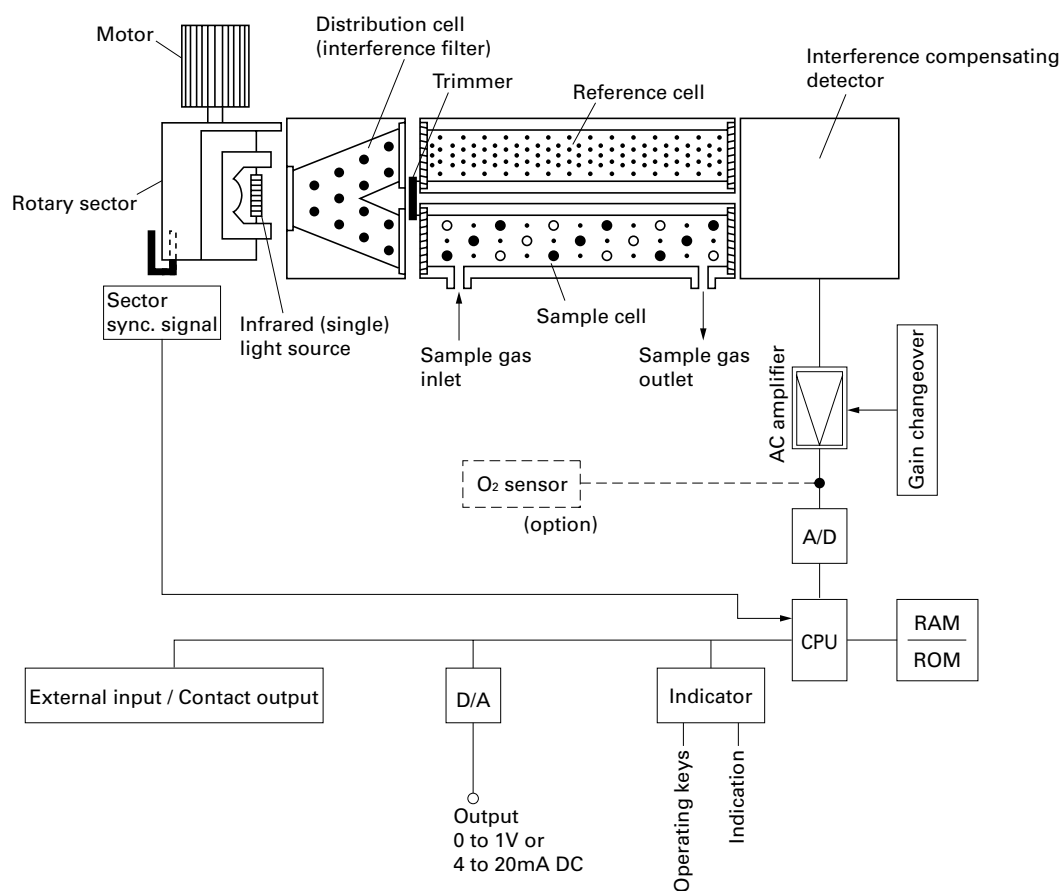
"Pollution Degree 2"

EN61326-1 : 2006, EN61326-2-3 : 2006

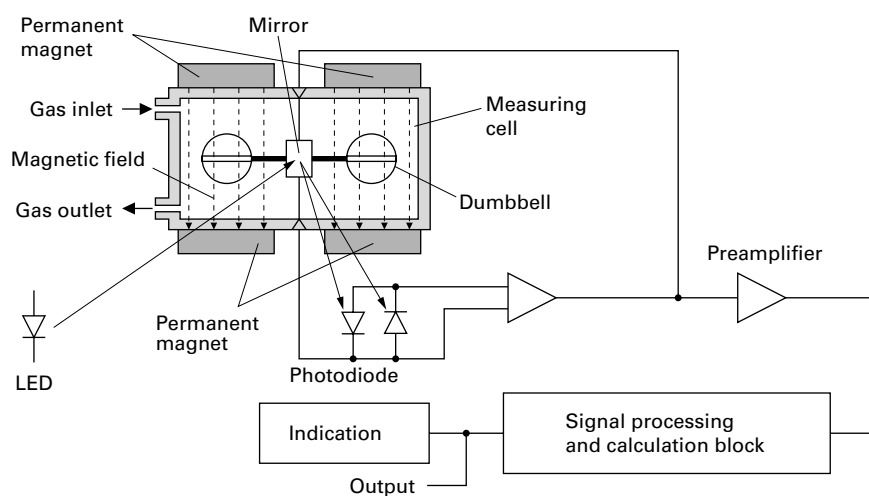
Electrical equipment for measurement, control and laboratory use — EMC requirements.

\*The product mounted in a steel enclosure conforms to the requirements of EMC directive.

## Principle diagram of NDIR type measurement (For NO, SO<sub>2</sub>, CO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub>O)



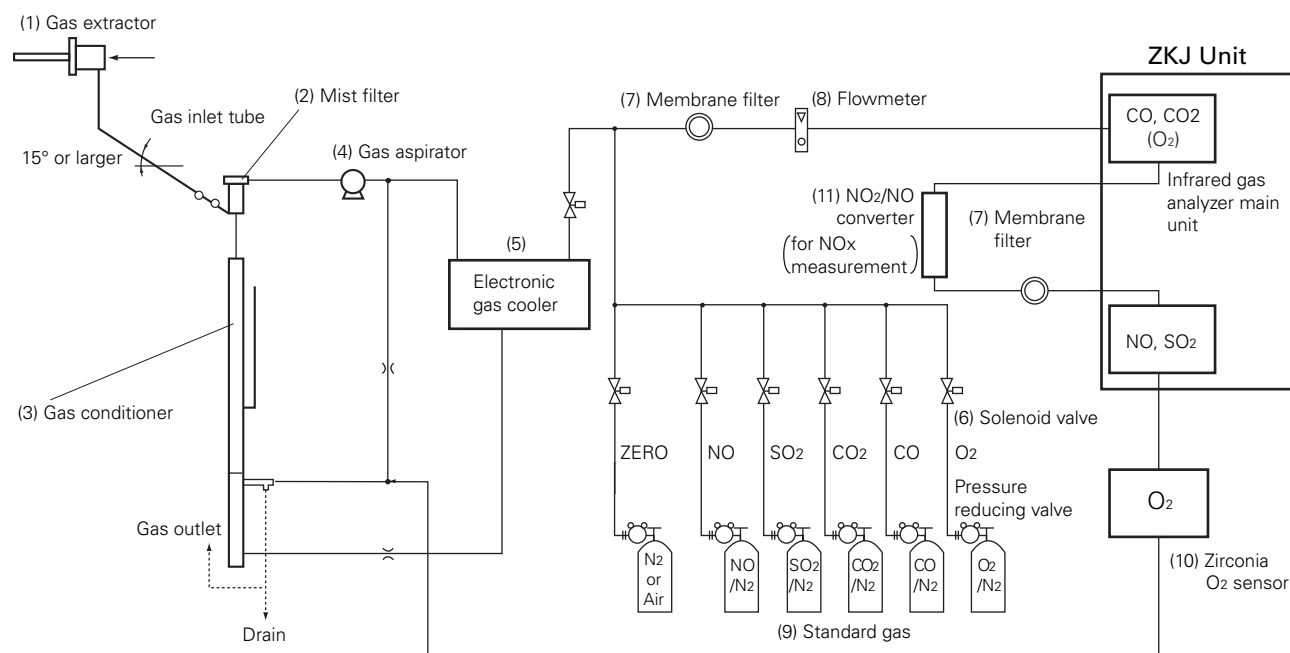
## Principle diagram of paramagnetic type measurement (For O<sub>2</sub>)



## Example configuration of gas sampling system

The following illustrates a typical system configuration for five component gas measurement for monitoring combustion exhaust gas from boiler, refuse incinerator, etc.

Contact FUJI ELECTRIC for system configuration matching the particular use or further information.



### Functions of Individual Components

- (1) **Gas extractor:** Gas extractor with a heating type stainless steel filter of standard mesh 40μm
- (2) **Mist filter:** For separation of drain and removal of dust and mist
- (3) **Safety drain trap:** Prevention of drain from being sucked and composite operation of constant-pressure bubbler
- (4) **Gas aspirator:** For aspiration of sample gas (sample gas flow rate approx. 2L/min)
- (5) **Electronic gas cooler:** Dries the moisture in sample gas to a dew point of approx. 3°C.
- (6) **Solenoid valve:** Used for introducing calibration gas.
- (7) **Membrane filter:** PTFE filter used to eliminate fine dust particles and permit monitoring of dust adhering condition on the front panel of the gas analyzer.

(8) **Flowmeter:** Adjusts and monitors the flow rate of sample gas.

(9) **Standard gas:** Reference gas used for calibrating zero and span of the analyzer. Total 6 cylinders required for air, zero gas, span gas NO, SO<sub>2</sub>, CO, CO<sub>2</sub> and O<sub>2</sub>.

(10) **Zirconia O<sub>2</sub> sensor:** (This is not necessary in case when the zirconia type O<sub>2</sub> sensor is built-in.) External zirconia oxygen sensor used for measuring the oxygen concentration (0 to 25%) in sample gas.

(11) **Converter:** Added to NO<sub>x</sub> analyzer. A special catalyst material for efficient conversion of NO<sub>2</sub> gas to NO is used.

\*(Note)

For each gas sampling device, refer to the separate Data Sheet for each gas sampling device.

## CODE SYMBOLS

← Digit No.  
of code



Digit	Description	note	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Digit No. of code
17	<Measuring range> 4th component	note 4	Z	K	J	F				4	-															
18	Minimum range	Maximum range																								
	None	None																								
	0 to 50ppm	0 to 1000ppm																								
	0 to 100ppm	0 to 2000ppm																								
	0 to 200ppm	0 to 500ppm																								
	0 to 200ppm	0 to 2000ppm																								
	0 to 200ppm	0 to 5000ppm																								
	0 to 500ppm	0 to 1%																								
	0 to 1000ppm	0 to 2%																								
	0 to 5000ppm	0 to 10%																								
	0 to 1%	0 to 20%																								
	0 to 2%	0 to 50%																								
	0 to 10%	0 to 20%																								
	0 to 10%	0 to 100%																								
19	<O <sub>2</sub> analyzer, 1st range>	note 4																								
20	Minimum range	Maximum range																								
	None	None																								
	0 to 5%	0 to 25%																								
	0 to 10%	0 to 25%																								
	Other																									
21	<Output>																									
	4 to 20mA DC																									
	0 to 1V DC																									
	4 to 20mA DC + Communication function																									
	0 to 1V DC + Communication function																									
22	<O <sub>2</sub> conversion and O <sub>2</sub> average value output>	note 6																								
	None	note 7																								
	With O <sub>2</sub> conversion output																									
	With peak alarm																									
	With O <sub>2</sub> conversion output and peak alarm																									
23	<Adjustment, Range designation>																									
	For combustion exhaust gas (specified range)	note 8a)																								
	For combustion exhaust gas																									
	For combustion exhaust gas (specified range)	note 8a)b)																								
	Unit mg/m <sup>3</sup>																									
	For combustion exhaust gas, Unit mg/m <sup>3</sup>	note 8b)																								
	Others	note 9																								

- Note 1** a) When "B" is specified at the 6th digit, O<sub>2</sub> sensor signal has to be set as 0-1V DC linear corresponding to full scale.  
b) External Zirconia O<sub>2</sub> sensor and external O<sub>2</sub> analyzer are not included in the scope of supply, and has to be separately ordered.
- Note 2** a) When "H", "L" and "M" with purging are specified at 5th digit, only one set of gas inlet/outlet is provided.  
In this case, NO<sub>2</sub>/NO converter cannot be mounted in between of two measuring cells.  
b) Resin coupling with purging cannot be manufactured.
- Note 3** Rated voltage and plug type of the attached power cable is different depending on the code "J", "E" and "U" in the 10th digit.  
Select appropriate code according to operation power supply voltage in the final destination.
- Note 4** Measuring range can be selected within either the minimum or maximum range.  
(Within min. or max. range, you can change the actual range settings locally.)  
Initial setting from Fuji factory is Min. range for the 1st range, and Max. range for the 2nd range.  
When range preset at Fuji factory is required, please select "specified range" at 23rd digit and inform Fuji of specified range table.  
Refer to Table 1, for possible combination of measuring components and ranges in the data sheet.
- Note 5** "1E" can be specified at 11th & 12th digits, ONLY for CO<sub>2</sub> measurement.  
In this case, be sure to select "with purging" at 7th digit.
- Note 6** O<sub>2</sub> conversion is calculated only for NO, SO<sub>2</sub> and CO.  
Both average value output after O<sub>2</sub> calculation and O<sub>2</sub> average value output are provided at the same time.  
a) Peak count alarm can be added only for CO measurement.
- Note 7** When "Y" is specified at the 6th digit, 22nd digit always has to be specified as "Y".
- Note 8** a) If you would like Fuji to deliver ZKJ analyzer with specific range setting, select "specified range" and separately inform Fuji of the actual range of each component together with your purchase order.  
b) In case that the measurement unit is specified as "mg/m<sup>3</sup>", it is necessary to select "unit : mg/m<sup>3</sup>" (Code "F" or "G") at the 23rd digit.  
Please refer to the table shown below for the corresponding range code based on "mg/m<sup>3</sup>".

Range code	Corresponding range in mg/m <sup>3</sup> or g/m <sup>3</sup>							
	In ppm		NO		SO <sub>2</sub>		CO	
	Min. range	Max. range	Min. range	Max. range	Min. range	Max. range	Min. range	Max. range
AF	0-50ppm	0-1000ppm	0-70mg/m <sup>3</sup>	0-1300mg/m <sup>3</sup>	0-150mg/m <sup>3</sup>	0-2800mg/m <sup>3</sup>	0-65mg/m <sup>3</sup>	0-1250mg/m <sup>3</sup>
BG	0-100ppm	0-2000ppm	0-140mg/m <sup>3</sup>	0-2600mg/m <sup>3</sup>	0-300mg/m <sup>3</sup>	0-5500mg/m <sup>3</sup>	0-130mg/m <sup>3</sup>	0-2500mg/m <sup>3</sup>
CH	0-200ppm	0-5000ppm	0-280mg/m <sup>3</sup>	0-6600mg/m <sup>3</sup>	0-600mg/m <sup>3</sup>	0-14g/m <sup>3</sup>	0-250mg/m <sup>3</sup>	0-6250mg/m <sup>3</sup>

- Note 9** When "Z" is specified at the 23rd digit, a gas composition table of actual measured gas has to be sent to Fuji together with your purchase order.
- Note 10** When only N<sub>2</sub>O analyzer is used, make sure not to contain any components other than N<sub>2</sub>O.  
Multicomponent analyzers including N<sub>2</sub>O analyzer + CO<sub>2</sub> analyzer are used for sludge incineration.  
In this case, the range of N<sub>2</sub>O is 0 to 200ppm/500ppm, and the range of CO<sub>2</sub> is 0 to 10%/20%.

**Table 1. Measurable component and range – availability check table –**

(1) Components of single-component analyzer and double-component analyzer (NO/CO), and CO of three-component analyzer (NO/SO<sub>2</sub>/CO)

As shown in the range code, when "P", "A", "D", "B", and "E" are specified at 5th digit, each component is given at 11th and 12th digits. When "H" is specified, NO is given at 11th and 12th digits and CO at 13th and 14th digits. When "L" is specified, CO is given at 15th and 16th digits.

Code symbol	Range code	1E	AF	BG	CH	EJ	FK
5th digit	Range	0-20ppm 0-500ppm	0-50ppm 0-1000ppm	0-100ppm 0-2000ppm	0-200ppm 0-5000ppm	0-500ppm 0-1%	0-1000ppm 0-2%
P,H	NO		○	○	○		
A	SO <sub>2</sub>		○	○	○	○	
D	CO <sub>2</sub>	○	○	○	○	○	○
B,H,L	CO		○	○	○	○	○
E	CH <sub>4</sub>				○	○	○

Code symbol	Range code	GL	HM	JN	KM	KP	MR	CG
5th digit	Range	0-2000ppm 0-5%	0-5000ppm 0-10%	0-1% 0-20%	0-2% 0-10%	0-2% 0-50%	0-10% 0-100%	0-200ppm 0-2000ppm
P,H	NO							
A	SO <sub>2</sub>				○			
D	CO <sub>2</sub>	○	○	○		○	○	
B,H,L	CO		○	○		○	○	
E	CH <sub>4</sub>	○	○	○		○	○	
Q	N <sub>2</sub> O							○

○ : Measurable

(2) NO/SO<sub>2</sub> of double-component analyzer (NO/SO<sub>2</sub>), three-component analyzer (NO/SO<sub>2</sub>/CO) and four-component analyzer (NO/SO<sub>2</sub>/CO<sub>2</sub>/CO)

Selection of NO/SO<sub>2</sub> when "F", "L" and "M" are specified at 5th digit of the code symbol.

Measurable components	Code symbol, 11th, and 12th digits.	Measurable components		2nd component SO <sub>2</sub>		
		Code symbol, 13th, and 14th digits.	2nd	AF	BG	CH
1st component, NO	AF	0-50ppm 0-1000ppm	0-50ppm 0-1000ppm	○	○	
	BG	0-100ppm 0-2000ppm	0-100ppm 0-2000ppm	○	○	
	CH	0-200ppm 0-5000ppm	0-200ppm 0-5000ppm			○

○ : Combination is available.

### (3) CO<sub>2</sub>/CO of double-component analyzer (CO<sub>2</sub>/CO) and 4-component analyzer (NO/SO<sub>2</sub>/CO<sub>2</sub>/CO)

When "G" is specified at 5th digit, CO<sub>2</sub> is given at 11th and 12th digits, and CO at 13th and 14th digits.  
When "M" is specified, CO<sub>2</sub> is given at 15th and 16th digits, and CO at 17th and 17th digits.

		Measurable components	2nd component, CO								
		Range code	AF	BG	CH	EJ	FK	HM	JN	KP	MR
Measurable components	Range code	2nd 1st	0-50ppm 0-1000ppm	0-100ppm 0-2000ppm	0-200ppm 0-5000ppm	0-500ppm 0-1%	0-1000ppm 0-2%	0-5000ppm 0-10%	0-1% 0-20%	0-2% 0-50%	0-10% 0-100%
1st component, CO <sub>2</sub>	AF	0-50ppm 0-1000ppm	○	○	○						
	BG	0-100ppm 0-2000ppm	○	○	○	○					
	CH	0-200ppm 0-5000ppm	○	○	○	○					
	EJ	0-500ppm 0-1%				○	○				
	FK	0-1000ppm 0-2%					○				
	GL	0-2000ppm 0-5%						○			
	HM	0-5000ppm 0-10%						○	○		
	JN	0-1% 0-20%							○	○	
	KP	0-2% 0-50%								○	
	MP	0-10% 0-100%									○
	MN	0-10% 0-20%	○	○	○	○					

○ : Combination is available.

### (4) N<sub>2</sub>O/CO<sub>2</sub> of 2-component analyzer N<sub>2</sub>O/CO<sub>2</sub>, 3-component analyzer NO/N<sub>2</sub>O/CO<sub>2</sub>, SO<sub>2</sub>/N<sub>2</sub>O/CO<sub>2</sub>, N<sub>2</sub>O/CO<sub>2</sub>/CO, CH<sub>4</sub>/N<sub>2</sub>O/CO<sub>2</sub> and 4-component analyzer (NO/SO<sub>2</sub>/N<sub>2</sub>O/CO<sub>2</sub>)

Range code: When code symbol is "R" or "U", N<sub>2</sub>O is 11th and 12th digit, CO<sub>2</sub> is 13th and 14th digit.  
When code symbol is "S", "T" or "V", N<sub>2</sub>O is 13th and 14th digit, CO<sub>2</sub> is 15th and 16th digit  
When code symbol is "W", N<sub>2</sub>O is 15th and 16th digit, CO<sub>2</sub> is 17th and 18th digit

		Measurable components	2nd component, CO <sub>2</sub>
		Range code	MN
Measurable components	Range code	2nd 1st	0-10% 0-20%
1st component, N <sub>2</sub> O	CE	0-200ppm 0-500ppm	○

○ : Combination is available.

### (5) CO<sub>2</sub> range selection of 3-component analyzer (N<sub>2</sub>O/CO<sub>2</sub>/CO)

Range code: N<sub>2</sub>O is 11th and 12th digit, CO<sub>2</sub> is 13th and 14th, CO is 15th and 16th digit.  
The range code of CO<sub>2</sub> is "MN".

		Measurable components	2nd component, CO
		Range code	BF
Measurable components	Range code	2nd 1st	0-100ppm 0-1000ppm
1st component, N <sub>2</sub> O	CE	0-200ppm 0-500ppm	○

○ : Combination is available.

(6) SO<sub>2</sub> range selection of 3-component analyzer (SO<sub>2</sub>/N<sub>2</sub>O/CO<sub>2</sub>)

Range code: SO<sub>2</sub> is 11th and 12th digit, N<sub>2</sub>O is 13th and 14th, CO<sub>2</sub> is 15th and 16th digit.  
The range code of CO<sub>2</sub> is "MN".

		Measurable components	2nd component, N <sub>2</sub> O
		Range code	CE
Measurable components	Range code		0-200ppm 0-500ppm
1st component, SO <sub>2</sub>	AF		○
		0-50ppm 0-1000ppm	

○ : Combination is available.

(7) CH<sub>4</sub> range selection of 3-component analyzer (CH<sub>4</sub>/N<sub>2</sub>O/CO<sub>2</sub>)

Range code: CH<sub>4</sub> is 11th and 12th digit, N<sub>2</sub>O is 13th and 14th, CO<sub>2</sub> is 15th and 16th digit.  
The range code of CO<sub>2</sub> is "MN".

		Measurable components	2nd component, N <sub>2</sub> O
		Range code	CE
Measurable components	Range code		0-200ppm 0-500ppm
1st component, CH <sub>4</sub>	CH		○
		0-200ppm 0-5000ppm	

○ : Combination is available.

(8) NO/SO<sub>2</sub>/N<sub>2</sub>O and 4-component analyzer (NO/SO<sub>2</sub>/N<sub>2</sub>O/CO<sub>2</sub>)

Range code: NO is 11th and 12th digit, SO<sub>2</sub> is 13th and 14th, N<sub>2</sub>O is 15th and 16th, CO<sub>2</sub> is 17th and 18th digit.  
The range code of CO<sub>2</sub> is "MN".

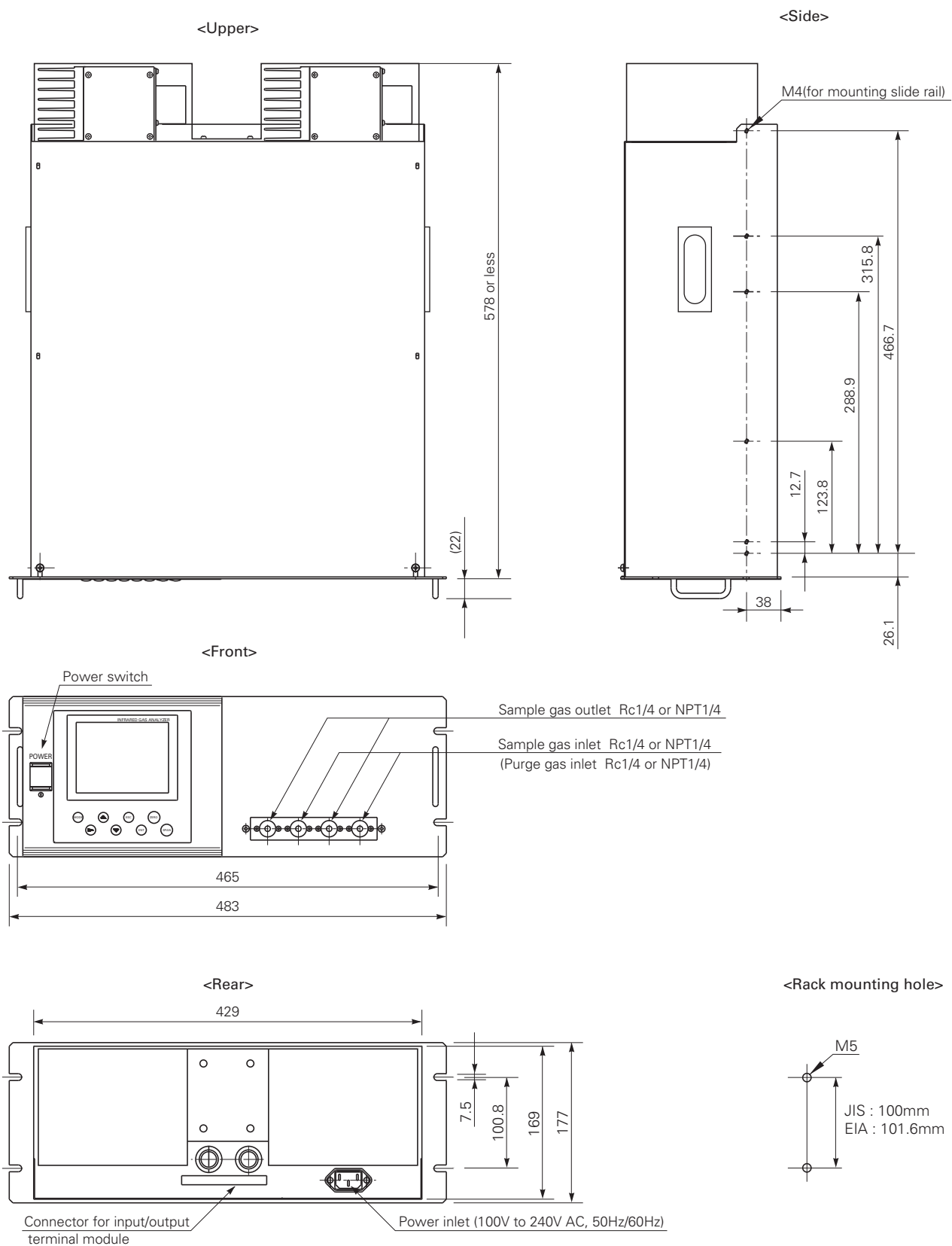
		Measurable components	2nd component, SO <sub>2</sub>	3rd component, N <sub>2</sub> O
		Range code	AF	CE
Measurable components	Range code		0-50ppm 0-1000ppm	0-200ppm 0-500ppm
1st component, NO	AF		○	○
	BG	0-100ppm 0-2000ppm	○	○

○ : Combination is available.

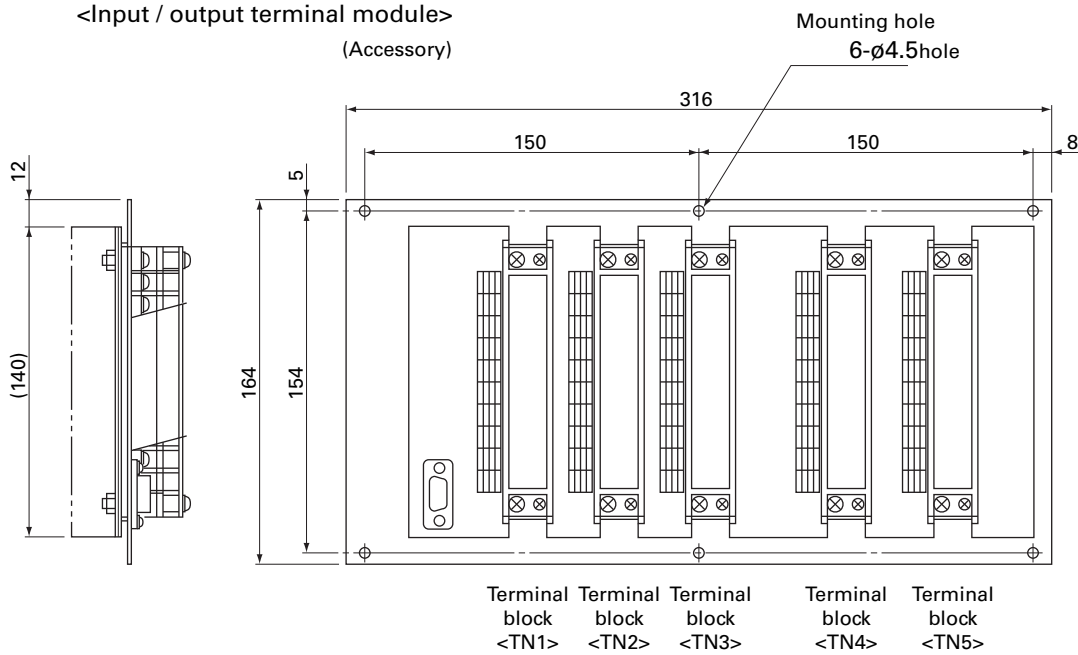


# OUTLINE DIAGRAM (Unit: mm)

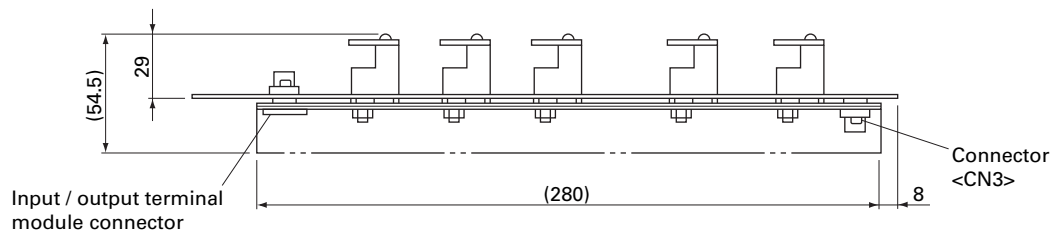
<Analyzer main unit>



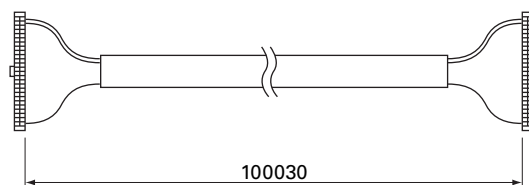
<Input / output terminal module>  
(Accessory)



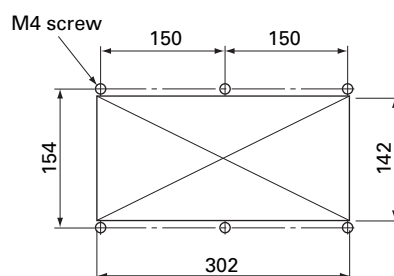
Screw terminals M3.5



<Cable for connecting input / output terminal>  
(Accessory)



<Dimensions for mounting input / output terminal module>

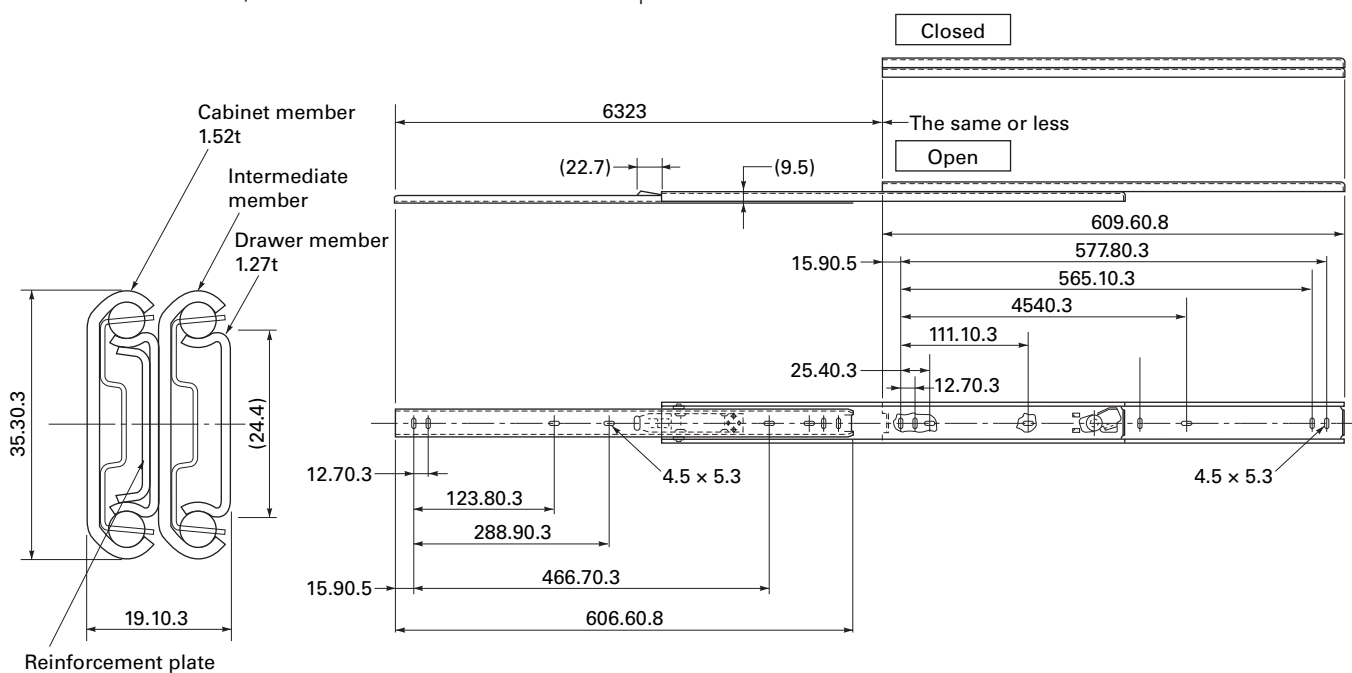


Cut M4 screw holes at 6 positions.  
Drill a rectangular hole of 302 × 142mm or more in the center.

## OUTLINE DIAGRAM OF ACCESSORY SLIDE RAIL (Unit: mm)

Model : 305A-24/Accuride International Inc. compatible.

\* The slide rails are attached to this equipment when designated.

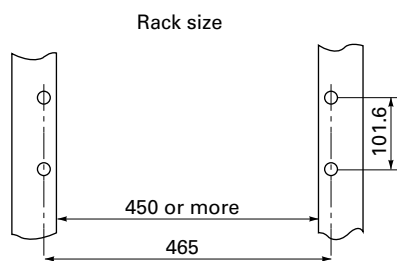


### 19-inch rack mounting method:

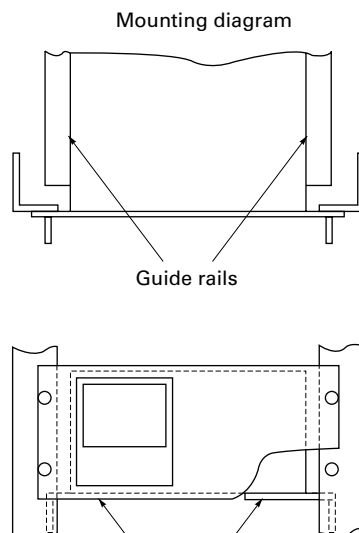
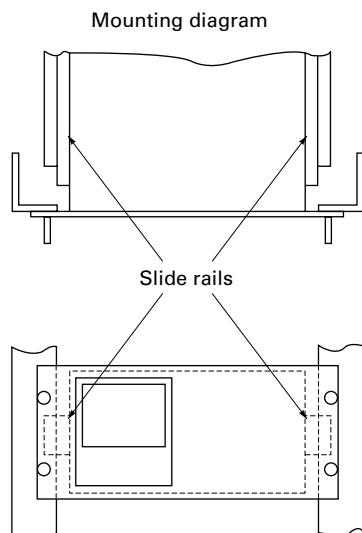
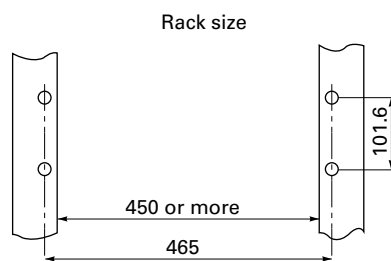
The mass of the instrument should be supported at the bottom of the unit (or the side of the unit when mounted with the slide rails).

Also, for facilitate maintenance, a structure which allows extraction of the main unit by using the slide rail is recommended.

Slide rail mounted type



Guide rail mounted type

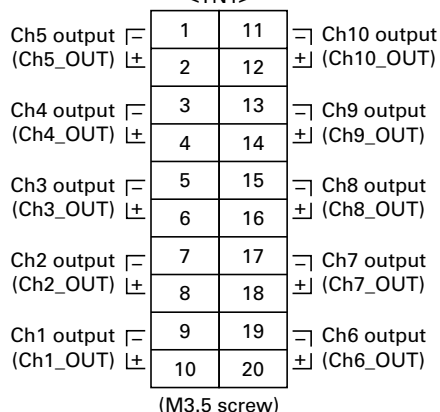


**Guide rails**  
For the guide rail mounted type, a maintenance space (200mm or more) should be provided upper the main unit.

## EXTERNAL CONNECTION DIAGRAM

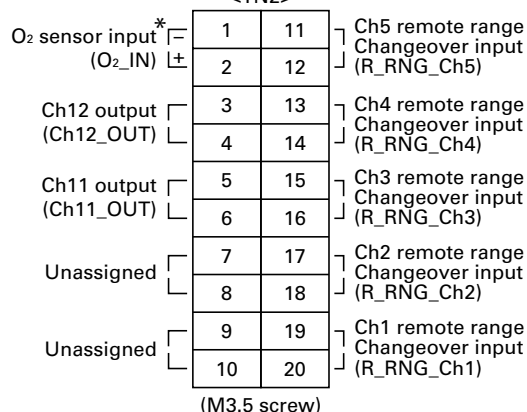
Terminal block 1

&lt;TN1&gt;



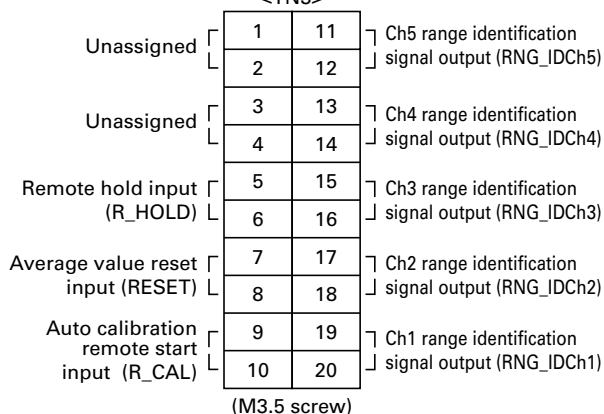
Terminal block 2

&lt;TN2&gt;

\* : For external O<sub>2</sub> sensor input.

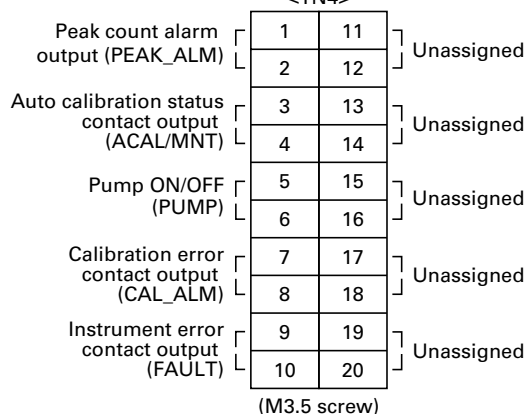
Terminal block 3

&lt;TN3&gt;



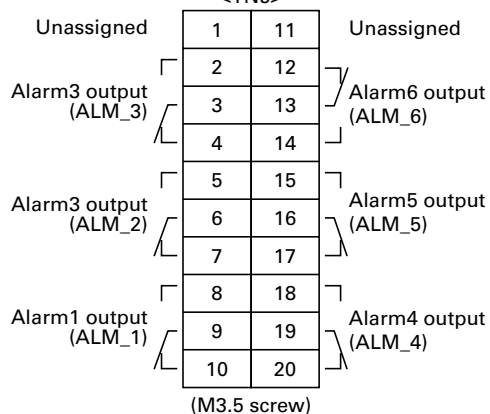
Terminal block 4

&lt;TN4&gt;



Terminal block 5

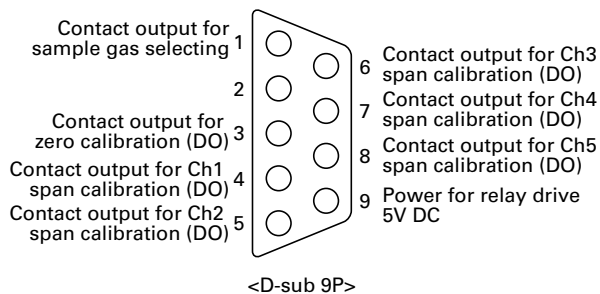
&lt;TN5&gt;



Connector

&lt;CN3&gt;

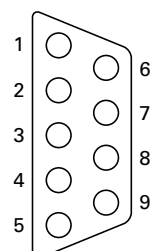
Solenoid valve drive signal output for calibration



Connector

&lt;CN2&gt;

For serial communication



Note 1) Unassigned terminals are used for internal connection. So they should not be used as repeating terminals either.

Note 2) The allocation of eaCh Channel (Ch1 to Ch12) depends on measured gas components. Refer to the table on the next page.

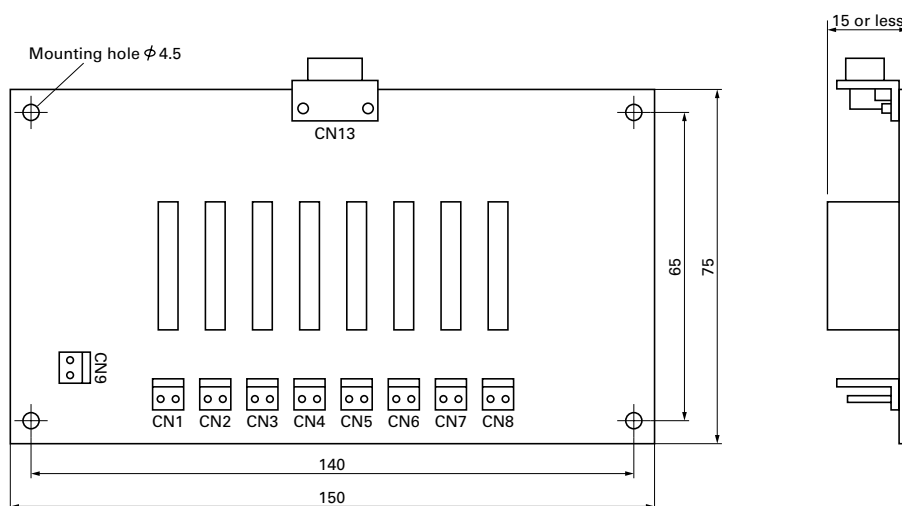


## Dedicated relay board

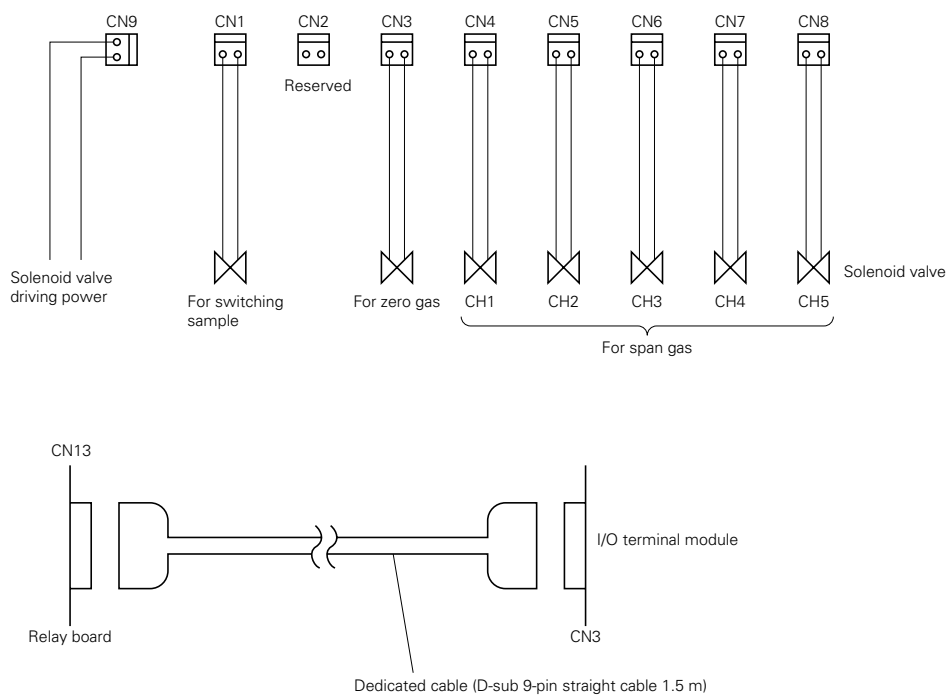
This relay board receives signals from connector CN3 of the ZKJ I/O terminal module and activates the calibration solenoid valve directly.

- Relay contact : 1 normally closed contact  
Contact capacity; 250V/2A AC  
(resistive load)

## OUTLINE DIAGRAM (Unit: mm)



## CONNECTIONS



## Recommended connector

- CN1 to CN9 : Housing ; VHR-2N  
(Nihon Solderless Terminal)
- Contact ; SVH-21T-1.1  
(Nihon Solderless Terminal)

## Contact action

- During measurement : CN1 ; ON  
Others ; OFF
- During calibration : CN1 ; OFF  
Others ; Contact corresponding to calibration timing is ON

**Table 2. Correspondence between measurement channels and measured value**

The following table gives measurement channels and their contents according to the code symbols.

Code symbol			Contents
5th digit	6th digit	22nd digit	
P	Y	Y	Ch1: NO
A	Y	Y	Ch1: SO <sub>2</sub>
D	Y	Y	Ch1: CO <sub>2</sub>
B	Y	Y	Ch1: CO
E	Y	Y	Ch1: CH <sub>4</sub>
F	Y	Y	Ch1: NO, Ch2: SO <sub>2</sub>
H	Y	Y	Ch1: NO, Ch2: CO
G	Y	Y	Ch1: CO <sub>2</sub> , Ch2: CO
L	Y	Y	Ch1: NO, Ch2: SO <sub>2</sub> , Ch3: CO
M	Y	Y	Ch1: NO, Ch2: SO <sub>2</sub> , Ch3: CO <sub>2</sub> , Ch4: CO
P	A, B, C	A	Ch1: NO <sub>x</sub> , Ch2: O <sub>2</sub> , Ch3: Converted NO <sub>x</sub> , Ch4: Converted NO <sub>x</sub> average, Ch5: O <sub>2</sub> average
A	A, B, C	A	Ch1: SO <sub>2</sub> , Ch2: O <sub>2</sub> , Ch3: Converted SO <sub>2</sub> , Ch4: Converted SO <sub>2</sub> average, Ch5: O <sub>2</sub> average
B	A, B, C	A	Ch1: CO, Ch2: O <sub>2</sub> , Ch3: Converted CO, Ch4: Converted CO average, Ch5: O <sub>2</sub> average
F	A, B, C	A	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: O <sub>2</sub> , Ch4: Converted NO <sub>x</sub> , Ch5: Converted SO <sub>2</sub> , Ch6: Converted NO <sub>x</sub> average, Ch7: Converted SO <sub>2</sub> average, Ch8: O <sub>2</sub> average
H	A, B, C	A	Ch1: NO <sub>x</sub> , Ch2: CO, Ch3: O <sub>2</sub> , Ch4: Converted NO <sub>x</sub> , Ch5: Converted CO, Ch6: Converted NO <sub>x</sub> average, Ch7: Converted CO average, Ch8: O <sub>2</sub> average
G	A, B, C	A	Ch1: CO <sub>2</sub> , Ch2: CO, Ch3: O <sub>2</sub> , Ch4: Converted CO, Ch5: Converted CO average, Ch6: O <sub>2</sub> average
L	A, B, C	A	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO, Ch4: O <sub>2</sub> , Ch5: Converted NO <sub>x</sub> , Ch6: Converted SO <sub>2</sub> , Ch7: Converted CO, Ch8: Converted NO <sub>x</sub> average, Ch9: Converted SO <sub>2</sub> average, Ch10: Converted CO average, Ch11: O <sub>2</sub> average
M	A, B, C	A	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO <sub>2</sub> , Ch4: CO, Ch5: O <sub>2</sub> , Ch6: Converted NO <sub>x</sub> , Ch7: Converted SO <sub>2</sub> , Ch8: Converted CO, Ch9: Converted NO <sub>x</sub> average, Ch10: Converted SO <sub>2</sub> average, Ch11: Converted CO average, Ch12: O <sub>2</sub> average
B	A, B, C	B	Ch1: CO, Ch2: O <sub>2</sub>
H	A, B, C	B	Ch1: NO, Ch2: CO, Ch3: O <sub>2</sub>
G	A, B, C	B	Ch1: CO <sub>2</sub> , Ch2: CO, Ch3: O <sub>2</sub>
L	A, B, C	B	Ch1: NO, Ch2: SO <sub>2</sub> , Ch3: CO, Ch4: O <sub>2</sub>
M	A, B, C	B	Ch1: NO, Ch2: SO <sub>2</sub> , Ch3: CO <sub>2</sub> , Ch4: CO, Ch5: O <sub>2</sub>
B	A, B, C	C	Ch1: CO, Ch2: O <sub>2</sub> , Ch3: Converted CO, Ch4: Converted CO average, Ch5: O <sub>2</sub> average
H	A, B, C	C	Ch1: NO <sub>x</sub> , Ch2: CO, Ch3: O <sub>2</sub> , Ch4: Converted NO <sub>x</sub> , Ch5: Converted CO, Ch6: Converted NO <sub>x</sub> average, Ch7: Converted CO average, Ch8: O <sub>2</sub> average
G	A, B, C	C	Ch1: CO <sub>2</sub> , Ch2: CO, Ch3: O <sub>2</sub> , Ch4: Converted CO, Ch5: Converted CO average, Ch6: O <sub>2</sub> average
L	A, B, C	C	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO, Ch4: O <sub>2</sub> , Ch5: Converted NO <sub>x</sub> , Ch6: Converted SO <sub>2</sub> , Ch7: Converted CO, Ch8: Converted NO <sub>x</sub> average, Ch9: Converted SO <sub>2</sub> average, Ch10: Converted CO average, Ch11: O <sub>2</sub> average
M	A, B, C	C	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO <sub>2</sub> , Ch4: CO, Ch5: O <sub>2</sub> , Ch6: Converted NO <sub>x</sub> , Ch7: Converted SO <sub>2</sub> , Ch8: Converted CO, Ch9: Converted NO <sub>x</sub> average, Ch10: Converted SO <sub>2</sub> average, Ch11: Converted CO average, Ch12: O <sub>2</sub> average
Q	Y	Y	Ch1:N <sub>2</sub> O
R	Y	Y	Ch1:N <sub>2</sub> O, Ch2:CO <sub>2</sub>
S	Y	Y	Ch1:NO, Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub>
T	Y	Y	Ch1:SO <sub>2</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub>
U	Y	Y	Ch1:N <sub>2</sub> O, Ch2:CO <sub>2</sub> , Ch3:CO
V	Y	Y	Ch1:CH <sub>4</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub>
W	Y	Y	Ch1:NO, Ch2:SO <sub>2</sub> , Ch3:N <sub>2</sub> O, Ch4:CO <sub>2</sub>
S	A, B, C	Y	Ch1:NO, Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> ,Ch4:O <sub>2</sub>
T	A, B, C	Y	Ch1:SO <sub>2</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> ,Ch4:O <sub>2</sub>
U	A, B, C	Y, B	Ch1:N <sub>2</sub> O, Ch2:CO <sub>2</sub> , Ch3:CO, Ch4:O <sub>2</sub>
V	A, B, C	Y	Ch1:CH <sub>4</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> ,Ch4:O <sub>2</sub>
W	A, B, C	Y	Ch1:NO, Ch2:SO <sub>2</sub> , Ch3:N <sub>2</sub> O, Ch4:CO <sub>2</sub> , Ch5:O <sub>2</sub>
S	A, B, C	A	Ch1:NO <sub>x</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> , Ch4:O <sub>2</sub> , Ch5:Converted NO <sub>x</sub> , Ch6:Converted NO <sub>x</sub> average, Ch7:O <sub>2</sub> average
T	A, B, C	A	Ch1:SO <sub>2</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> ,Ch4:O <sub>2</sub> , Ch5:Converted SO <sub>2</sub> , Ch6:Converted SO <sub>2</sub> average, Ch7:O <sub>2</sub> average
U	A, B, C	A, C	Ch1:N <sub>2</sub> O, Ch2:CO <sub>2</sub> , Ch3:CO, Ch4:O <sub>2</sub> , Ch5:Converted CO, Ch6:Converted CO average, Ch7:O <sub>2</sub> average
V	A, B, C	A	Ch1:CH <sub>4</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> ,Ch4:O <sub>2</sub> ,Ch5:O <sub>2</sub> average
W	A, B, C	A	Ch1:NO <sub>x</sub> , Ch2:SO <sub>2</sub> , Ch3:N <sub>2</sub> O, Ch4:CO <sub>2</sub> , Ch5:O <sub>2</sub> , Ch6:Converted NO <sub>x</sub> , Ch7:Converted SO <sub>2</sub> , Ch8:Converted NO <sub>x</sub> average, Ch9:Converted SO <sub>2</sub> average, Ch10:O <sub>2</sub> average

note

## Exclusive Zirconia O<sub>2</sub> Sensor (to be purchased separately)

For O<sub>2</sub> correction, the gas analyzer ZKJ can accept linealized 0 to 1V DC signal coming from analyzer calibrated 0 to 25% O<sub>2</sub> full scale. If the analyzer is not available, Fuji can supply exclusive Zirconia O<sub>2</sub> sensor Model ZFK.

**Measuring method:**

Zirconia system

**Measurable component and measuring range:**

Measurable component	Range
O <sub>2</sub>	Oxygen
	0 to 25vol%

**Repeatability:** Within ± 0.5% of full scale

**Linearity:** Within ± 1% of full scale

**Zero drift:** Within ± 1% of full scale/week

**Span drift:** Within ± 2% of full scale/week

**Response time:** Approx. 20 seconds (for 90% response)

**Measured gas flow rate:**

0.5 ± 0.25L / min

Remark: The Zirconia system, due to its principle, may produce a measuring error due to relative concentration versus the com-bustible O<sub>2</sub> gas concentration. Also, a corrosive gas (SO<sub>2</sub> of 250 ppm or more, etc.) may affect the life of the sensor.

**Gas inlet/outlet size:**

Rc<sup>1</sup>/<sub>4</sub> or NPT<sup>1</sup>/<sub>4</sub>

**Power supply:** Rated voltage ; 100 to 115V AC or 200 to 240V AC

Rated frequency ; 50Hz/60Hz

Max. rated power ; 215VA (during power ON)

65VA (during steady-state operation)

**Enclosure:** Steel casing, for indoor application

**Indication:** Temperature indication (LED)

**Temperature alarm output:**

Contact output 1a contact,

Contact capacity 220V, 1A AC (resistive load)

**Outer dimensions (H x W x D):**

141 x 170 x 190mm

**Mass {weight}:** Approx. 3kg

**Finish color:** Munsell 5Y 7/1



## CODE SYMBOLS

1	2	3	4	5	6	7	8	9	10	11	12	13	Description
Z	F	K	7	Y	Y	4	-	Y	0	Y	Y		<b>Measuring method</b>
													Zirconia method
													<b>Power supply</b>
													100 to 115V AC 50/60Hz(Standard)
													200 to 240V AC 50/60Hz(Standard)
													200 to 240V AC 50/60Hz(CE mark)
													<b>Gas inlet/outlet size</b>
													Rc <sup>1</sup> / <sub>4</sub>
													NPT <sup>1</sup> / <sub>4</sub>

## SCOPE OF DELIVERY

- Gas analyzer ... 1 unit
- Input /output terminal module for external mounting ... 1 set
- Connection cable (1m) between main unit and input / output terminal module ... 1 pc
- Power cable (standard inlet type 2m) ... 1 pc
- Spare fuses (250V, 3.15A AC, delay type) ... 2 pcs
- Instruction manual ... 1 copy
- Slide rails ... 2 pcs (when with slide rails are selected)
- Relay board ... 1 pc (when with relay board are selected)
- Cable for relay board ... 1 pc (when with relay board are selected)

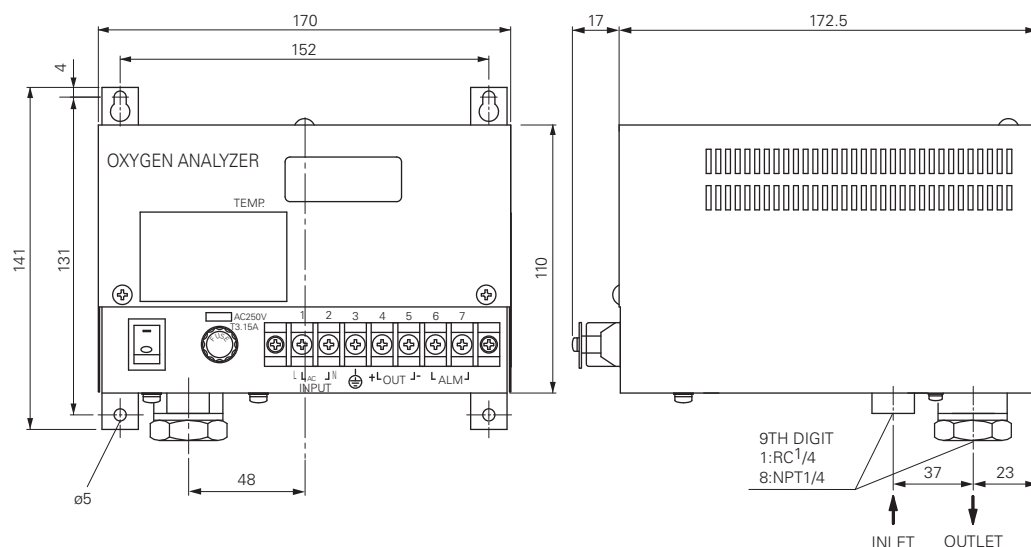
## ORDERING INFORMATION

1. Code symbols
2. Application and composition of sample gas

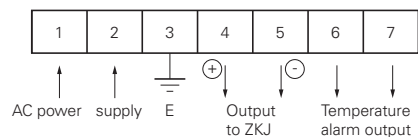
## Items to be prepared separately

- Various sampling devices (refer to Data Sheets for the sampling devices)
- Dedicated zirconia O<sub>2</sub> sensor (see Page 16)

## OUTLINE DIAGRAM (Unit:mm)



## EXTERNAL CONNECTION DIAGRAM



⚠ Caution on Safety

\*Before using this product, be sure to read its instruction manual in advance.

**F** Fuji Electric Co., Ltd.

Global Sales Section

Instrumentation & Sensors Planning Dept.

1, Fuji-machi, Hino-city, Tokyo 191-8502, Japan

<http://www.fujielectric.com>

Phone: +81-42-514-8930 Fax: +81-42-583-8275

<http://www.fujielectric.com/products/instruments/>





## Instruction Manual

# **NDIR TYPE INFRARED GAS ANALYZAR**

**TYPE: ZKJ-4**

# PREFACE

Thank you very much for purchasing Fuji's Infrared Gas Analyzer.

- Be sure to read this instruction manual carefully before performing installation, wiring, operation, and maintenance of the analyzer. Improper handling may result in accidents or injury.
- The specifications of this analyzer are subject to change without prior notice for further product improvement.
- Modification of this analyzer is strictly prohibited unless a written approval is obtained from the manufacturer. Fuji will not bear any responsibility for a trouble caused by such a modification.
- The person who actually operates the analyzer should keep this instruction manual.
- After reading through the manual, be sure to keep it near at hand for future reference.
- This instruction manual should be delivered to the end user without fail.

Manufacturer : Fuji Electric Co., Ltd.  
Type : Described in the nameplate on main frame  
Date of manufacture : Described in the nameplate on main frame  
Country of manufacture : Japan

## Delivered Items

Name	Quantity	Remarks
Analyzer main frame	1 unit	
Input/Output terminal module	1 set	
Connection cable	1 pc	
Power cable	1 pc	
Fuse	2 pcs	250V AC/3.15A
Cell window mounting tool	1 pc	With mounting block cell
Slide rail	2 pcs	When specified
Relay board for auto calibration	1 pc	When specified
Relay board connection cable	1 pc	When specified
Instruction manual	1 copy	

## Request

- No part or the whole of this manual may be reproduced without written permission of Fuji.
- Description in this manual is subject to change without prior notice for further improvement.

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2011




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## CAUTION ON SAFETY



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To operate the analyzer properly, be sure to read “Caution on Safety” carefully.


- The descriptions listed here provide important information on safety. Be sure to observe them at all times. Those safety precautions are classified into 3 levels, “DANGER,” “CAUTION” and “PROHIBITION.”



 <b>DANGER</b>	Improper handling may cause dangerous situations that may result in death or serious injury.
 <b>CAUTION</b>	Improper handling may cause dangerous situations that may result in medium-level troubles, minor injury, or property damage.
 <b>PROHIBITION</b>	Items which must not be done are noted.


### Caution on installation and transport of gas analyzer



 <b>DANGER</b>	<ul style="list-style-type: none"><li>• The unit is not of explosion-proof specifications. Do not use it in an atmosphere of explosive gases. Otherwise serious accidents such as explosion or fire may result.</li></ul>
 <b>CAUTION</b>	<ul style="list-style-type: none"><li>• Install the analyzer, observing the rules provided in this manual, in a place that endures the weight of the analyzer. Installation in an inadequate place may cause turnover or fall, resulting in injury.</li><li>• Be sure to wear protective gloves when lifting the analyzer. Lifting it with bare hands may result in injury.</li><li>• Be sure to fix the casing before transporting the analyzer. Transportation in unstable state may result in injury.</li><li>• The gas analyzer is heavy. Two or more persons should carry it, while exercising due care. Otherwise unexpected harm to your body or injury may result.</li><li>• Take care not to let cable chips and other foreign objects enter the unit during installation work. Otherwise fire, failure, or malfunction may result.</li></ul>


Caution on piping	
 <b>DANGER</b>	<p>Be sure to observe the following precautions while installing piping. Improper piping may result in gas leakage.</p> <p><b>If the leaking gas contains a toxic component, serious accidents may result. If it contains combustible gases, explosion or fire may result.</b></p> <ul style="list-style-type: none"> <li>• Connect pipes correctly referring to the instruction manual.</li> <li>• Discharge the exhaust gas outdoors to prevent it from remaining within the sampling device or indoors.</li> <li>• Relieve the exhaust gas from the analyzer to the atmospheric pressure to prevent buildup of undesirable pressure to the analyzer. Otherwise piping within the analyzer may be disconnected, resulting in gas leakage.</li> <li>• Use pipes and pressure reducing valves to which no oil/grease is attached for piping. Otherwise, fire may result.</li> </ul>

Caution on wiring	
 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>• Be sure to turn off the power before installing wiring. Otherwise electric shock may result.</li> <li>• Be sure to perform class D grounding work. Otherwise, electric shock or failure may result.</li> <li>• Select a proper wiring material that satisfies the ratings of the instrument. Otherwise, electric shock or fire may result.</li> <li>• Be sure to connect a power supply of correct rating. Otherwise, fire may result.</li> </ul>

Caution on use	
 <b>DANGER</b>	<ul style="list-style-type: none"> <li>• Be sure to read the instruction manual for reference gases before handling reference gases such as calibration gas to use them properly.</li> </ul>
 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>• Leaving the analyzer unused for a long time or restarting it after long-term suspension requires procedures different from normal operation or suspension procedures. Be sure to follow the instructions in each instruction manual. Otherwise, intended performance may not be achieved, or accidents or injury may result.</li> <li>• Do not operate the analyzer for a long time with its door left open. Otherwise, dust, foreign matter, etc. may stick on internal walls, thereby causing faults.</li> </ul>

Caution on use	
 <b>PROHIBITION</b>	<ul style="list-style-type: none"> <li>• Do not touch the input/output terminals with metal or finger. Otherwise, electric shock or injury may result.</li> <li>• Do not smoke or use flames near the analyzer. Otherwise, fire may result.</li> <li>• Do not allow water to enter the analyzer. Otherwise, electric shock or internal fire may result.</li> </ul>

Caution on maintenance and check	
 <b>DANGER</b>	<ul style="list-style-type: none"> <li>• Before performing work with the cover of the analyzer kept open for maintenance and check, be sure to purge completely not only within the analyzer but also measuring gas lines with nitrogen or air. Otherwise, poisoning, fire, or explosion may result due to gas leakage.</li> </ul>
 <b>CAUTION</b>	<p><b>Be sure to observe the following to perform work safely, avoiding electric shock or injury.</b></p> <ul style="list-style-type: none"> <li>• Remove the watch and other metallic objects before work.</li> <li>• Do not touch the instrument wet-handed.</li> <li>• If the fuse is blown, eliminate the cause and replace it with the one of the same capacity and type. Otherwise, electric shock or accidents may result.</li> <li>• Do not use replacement parts other than those specified by the manufacturer. Otherwise, intended performance may not be achieved, or accidents or failures may result.</li> <li>• Dispose replacement parts such as maintenance parts as incombustibles according to the local waste disposal regulations.</li> </ul>

Others	
 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>• If the cause of a fault cannot be identified by referring to the instruction manual, be sure to contact your dealer or Fuji's technician in charge of adjustment. Disassembling the instrument carelessly may result in electric shock or injury.</li> </ul>



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# 1. OVERVIEW

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This infrared gas analyzer (type: ZKJ) measures the concentration of NO, SO<sub>2</sub>, CO<sub>2</sub>, CO and CH<sub>4</sub> contained in sampling gas on the principle that different atomic molecules have an absorption spectrum in the wave band of infrared rays, and the intensity of absorption is determined by the Lambert-Beer law.

Since this instrument incorporates a compact paramagnetic O<sub>2</sub> sensor, it allows measuring up to 5 components simultaneously by using the built-in O<sub>2</sub> sensor (up to 4 components if O<sub>2</sub> sensor is excluded).

Furthermore, use of a microprocessor or large sized liquid crystal display realizes improvement of operability, accuracy and multi-functions.

This instrument is optimum for measuring combustible gas exhausted from boilers or incinerators, and it is effective for steel gas analysis (blast furnace, steel converter, thermal treatment furnace, sintering (Pellet equipment), coke furnace), storage and maturity of vegetable and fruit, biochemistry (microbe), [fermentation], air pollution [incinerator, exhaust gas desulfurization, denitration], automotive emission (excluding tester), protection against disasters [detection of explosive gas and toxic gas, combustion gas analysis of new building material], growth of plants, chemical analysis [petroleum refinery plant, petroleum chemistry plant, gas generation plant], environment [land concentration, tunnel concentration, parking lot, building management] and various physical and chemical experiments.

## 2. NAME AND DESCRIPTION OF EACH UNIT

### 2.1 Name and description of main unit

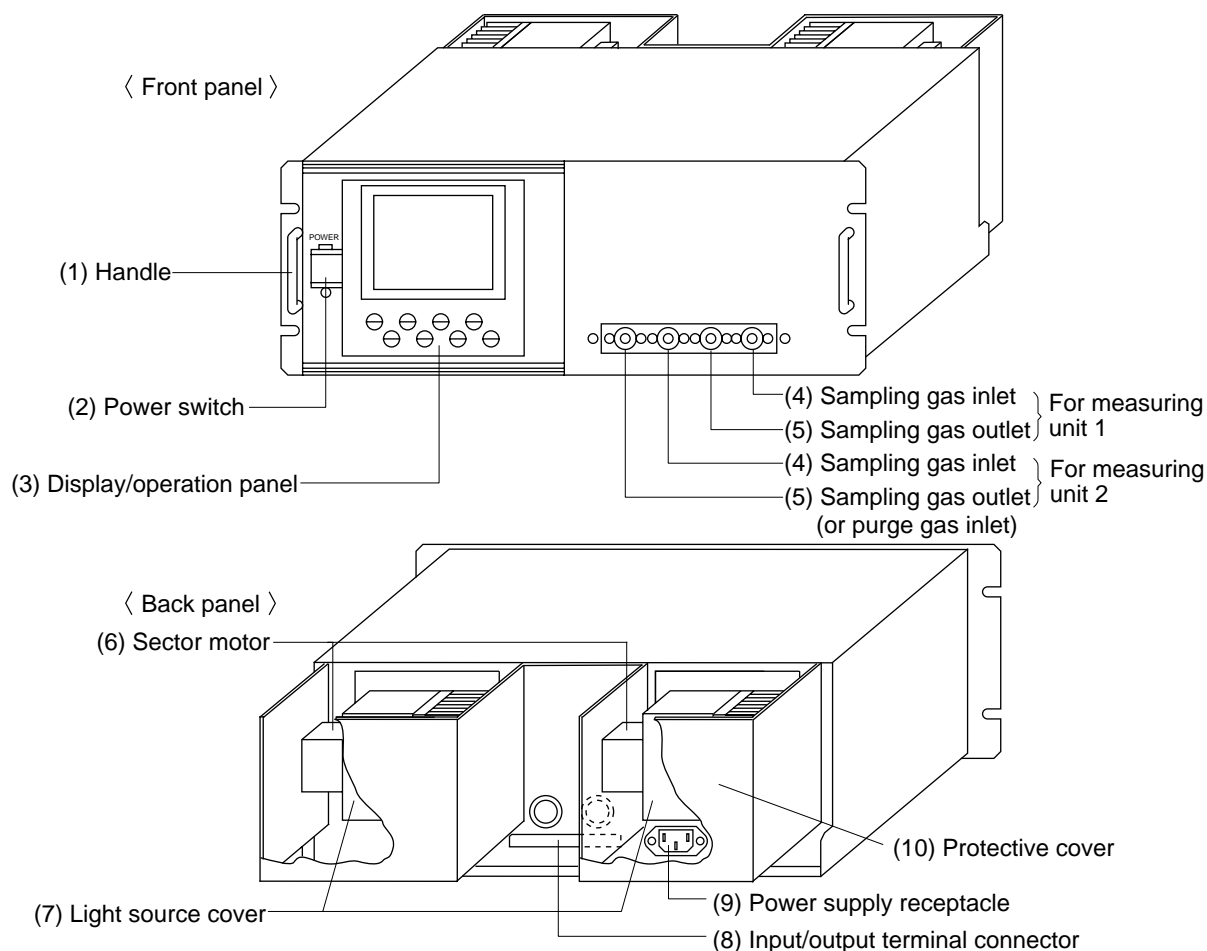


Fig. 2-1

Name	Description	Name	Description
(1) Handle	Used for withdrawing the main unit from the panel.	(6) Sector motor	For driving the rotation of sector
(2) Power switch	Used for ON/OFF the analyzer.	(7) Light source cover	Infrared light source is arranged in the cover.
(3) Display/operation panel	Liquid crystal display and keys for setting various functions	(8) Input/output terminal connector	For connecting to the external input/output terminal module
(4) Sampling gas inlet	For connecting to the measuring gas tube	(9) Power inlet	For connecting the power cable
(5) Sampling gas outlet	Connect to the exhaust line. (A pair of sampling gas inlet/outlet is provided for each measuring unit. When ordered with purge, the piping to measuring unit 2 is built inside. In this case, the sample gas outlet for measuring unit 2 is used for purge gas inlet.)	(10) Protective cover	Protective cover for the light source and the motor. May be removed during operation.

## 2.2 Input/Output terminal module

This analyzer provides input/output of various signals from the supplied input/output terminal module by connecting the instrument to this module.

〈 Input/Output terminal module 〉

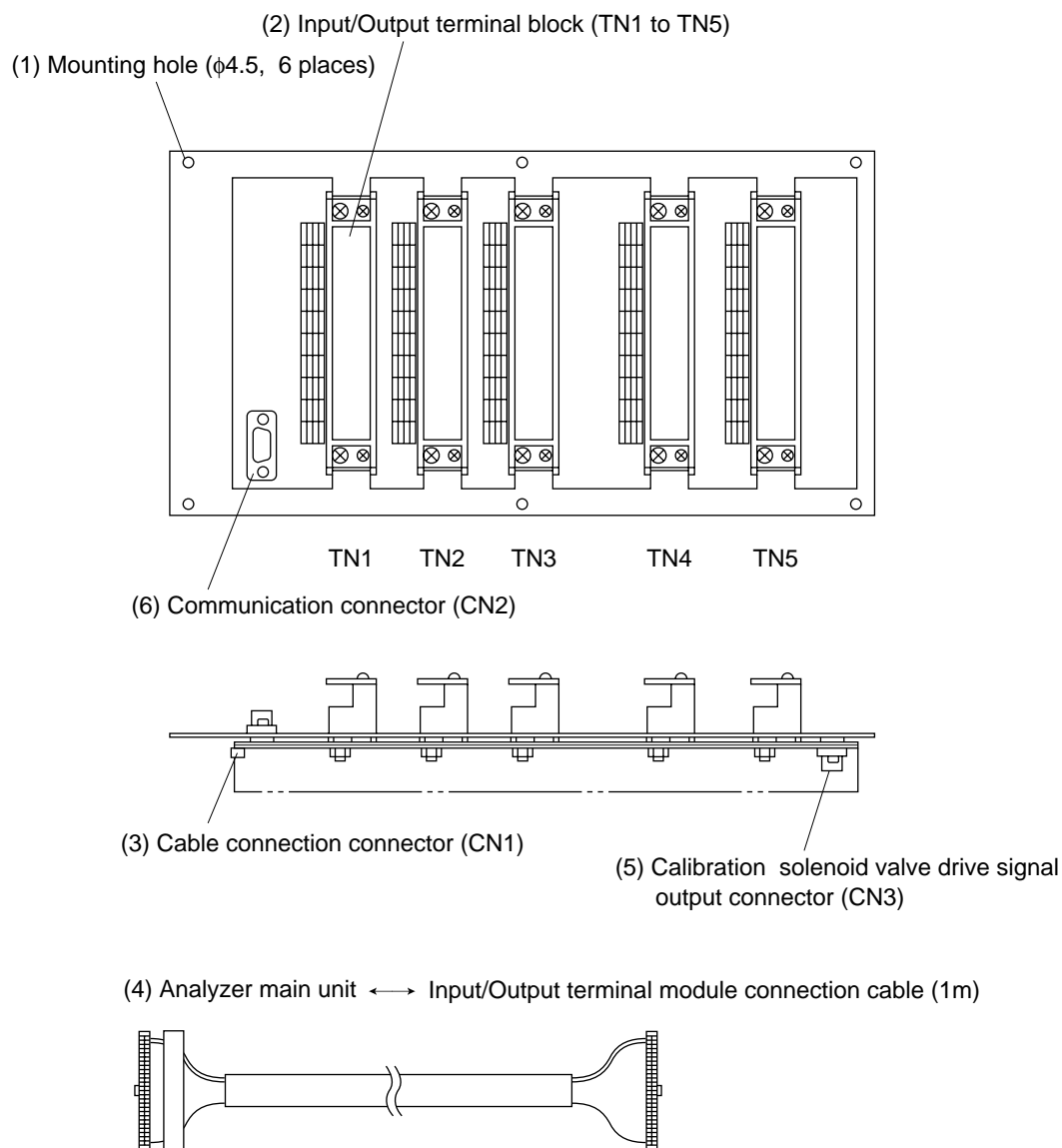


Fig. 2-2

Name	Description	Name	Description
(1) Mounting hole	Used for mounting input/output terminal module. φ 4.5, 6 places	(4) Input/output terminal module connection cable	Used for connecting the analyzer main unit to the input/output terminal module.
(2) Input/output terminal block (TN 1 to TN 5)	Input/output terminal for signals of analog output, range identification contact, alarm contact output, etc.	(5) Calibration solenoid valve drive signal output connector	Cable connector for connecting the analyzer to the relay board for automatic calibration.
(3) Cable connection connector	Used for connecting the analyzer main unit and the input/output terminal module (4).	(6) Communication connector	Connect communication cable. *Please refer to another manual (INZ-TN513327-E) about communication function.



### 3. INSTALLATION

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#### **DANGER**

This unit is not explosion-proof type. Do not use it in a place with explosive gases to prevent explosion, fire or other serious accidents.

#### **CAUTION**

- Entrust the installation, movement or re-installation to a specialist or the supplier. A poor installation may cause accidental tipover, shock hazard, fire, injury, etc.
- The gas analyzer is heavy. It should be installed with utmost care. Otherwise, it may tip over or drop, for example, causing accident or injury.
- For lifting the gas analyzer, be sure to wear protective gloves. Bare hands may invite an injury.
- This unit should be installed in a place which conforms to the conditions noted in the instruction manual. Otherwise, it may cause electric shocks, fire or malfunction of the unit.
- During installation work, care should be taken to keep the unit free from entry of cable chips or other foreign objects. Otherwise, it may cause fire, trouble or malfunction of the unit.

#### 3.1 Installation conditions

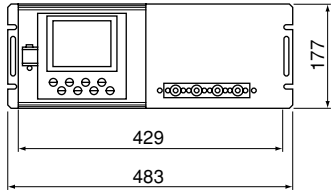
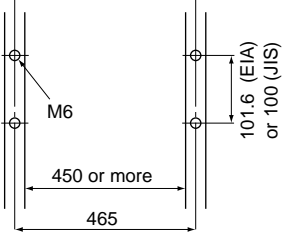
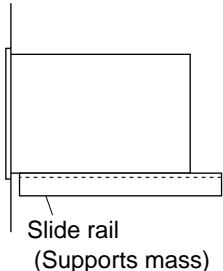
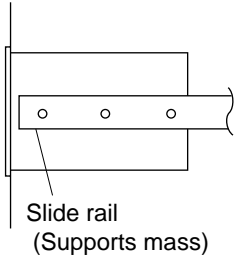
To install the analyzer for optimum performance, select a location that meets the following conditions;

- (1) This instrument is system built in type. This instrument should be used while embedded in a panel, locker, or enclosure of steel sheet.
- (2) Use this instrument indoors.
- (3) A vibration-free place
- (4) A place which is clean around the analyzer.
- (5) Power supply
  - Rated voltage : 100V to 240V AC
  - Operating voltage : 85V to 264V AC
  - Rated frequency : 50/60 Hz
  - Power consumption : 250 VA max.
  - Inlet : Conformity to EN60320 class I type 3-pin inlet
- (6) Operation conditions
  - Ambient temperature : -5° to 45°C
  - Ambient humidity : 90 % RH or less, no condensation

## 3.2 Installation

### 3.2.1 Installation of analyzer main frame

Installation methods for the analyzer main unit are divided into 2 types;

Type	External dimensions	Mounting dimensions	Mounting method
19 inch rack mounting guide rail method			
19 inch rack mounting slide rail method			

Note 1 Check and maintenance of the analyzer main unit may be carried out with the top cover detached. The guide rail method may be used if a space accessible for maintenance is provided at the top of the main unit. If maintenance space is not provided specially, it is recommended to use the slide rail method.

Recommended slide rail: Product No.: 305A-24 manufactured by Accuride International Co.

Note 2 For 19 inch rack mounting, the weight of the analyzer is supported with the bottom of the case (with the side of the case in case of slide rail method). For mounting dimensions of the slide rail, see "Item 9.3 External diagram".

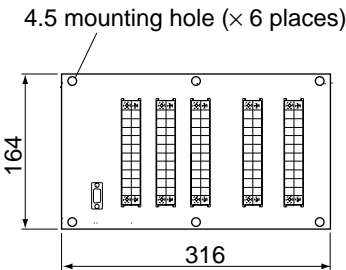
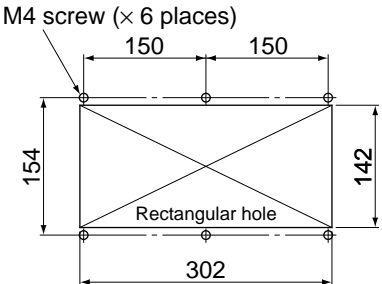
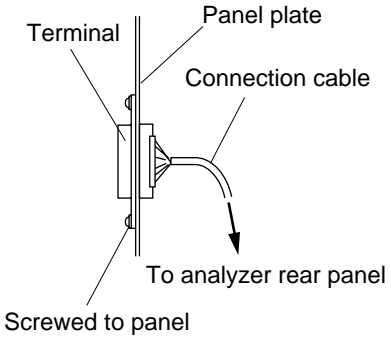
Don't install the analyzer at a place which is exposed to direct sunlight.

The analyzer should be installed at a place where ambient temperature is within  $-5$  to  $45^{\circ}\text{C}$ , and temperature fluctuation during use is minimum.

### 3.2.2 Mounting input/output terminal module

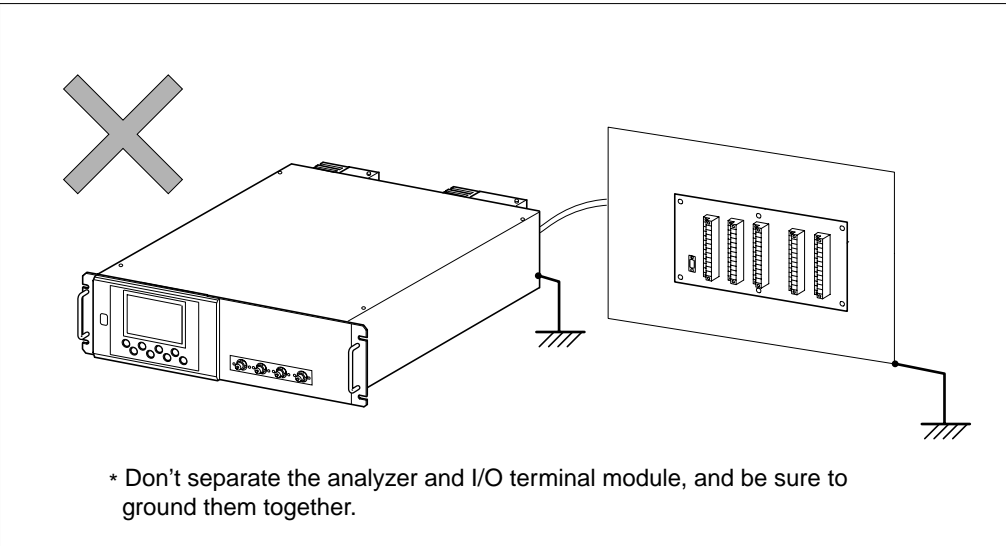
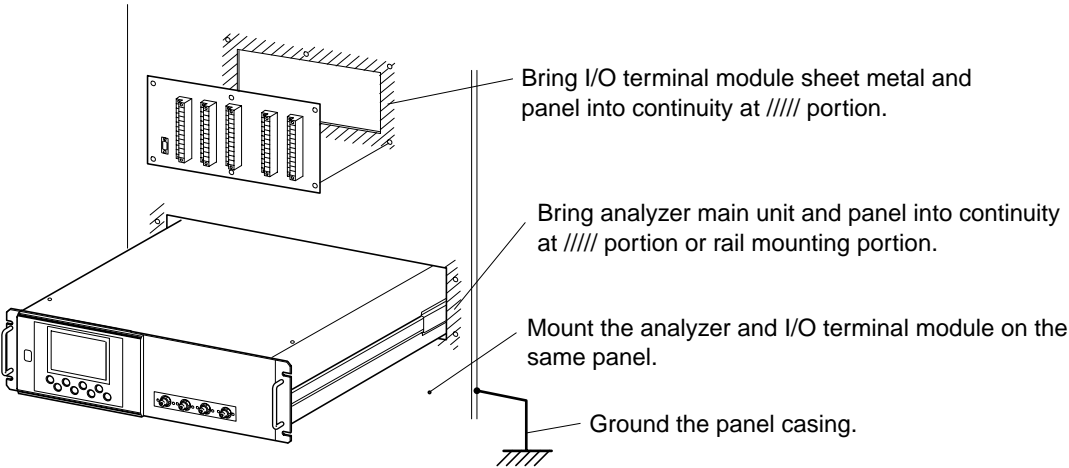
Mount the input/output terminal module on the panel; observing the following method.

**(Note) To avoid the effect of noise generated from external units, mount the I/O terminal module mounting plate on the panel for continuity at the mounting surface and connect the panel to the same ground as the analyzer main unit.**

External dimensions	Mounting dimensions	Mounting method
 <p>4.5 mounting hole (× 6 places)</p> <p>164</p> <p>316</p>	 <p>M4 screw (× 6 places)</p> <p>150</p> <p>150</p> <p>154</p> <p>142</p> <p>302</p> <p>Rectangular hole</p>	 <p>Terminal</p> <p>Panel plate</p> <p>Connection cable</p> <p>To analyzer rear panel</p> <p>Screwed to panel</p>

**Note) How to ground analyzer main unit and I/O terminal module**

To avoid the effect of noises, etc. from external units, it is recommended to ground them by the procedure described below.



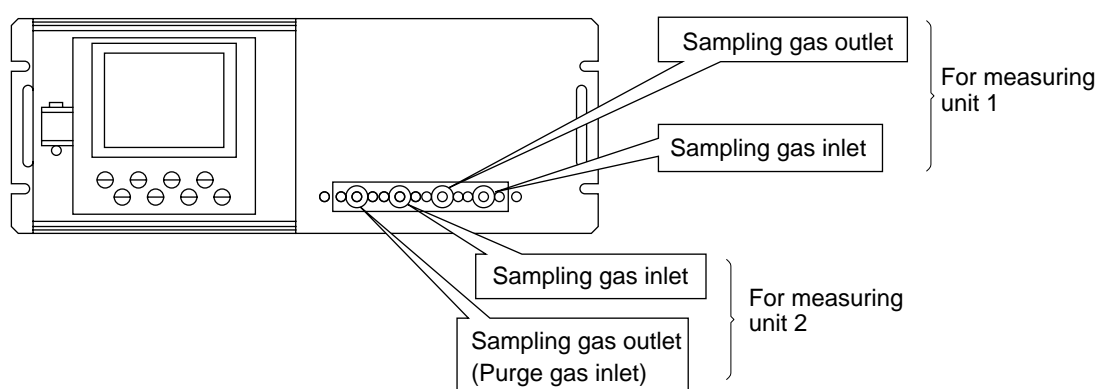
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### 3.3 Piping

Piping should be connected to the gas inlets and outlets of the front panel of the analyzer.

- Use a corrosion resistant tube of Teflon, stainless or polyethylene to connect the instrument to a sampling system. Even if there is a danger of corrosion, refrain from using a tube of rubber or soft vinyl. The instrument provides inaccurate indication due to gas absorption by piping materials.
- Pipe connection port is Rc1/4 female thread (or NPT1/4). Piping should be cut as short as possible for a quick response. About 4 mm inner diameter is recommended.
- Entry of dust into the instrument may result in defective operation. Use a clean piping or coupling.

Connect the gas tube by the following method.

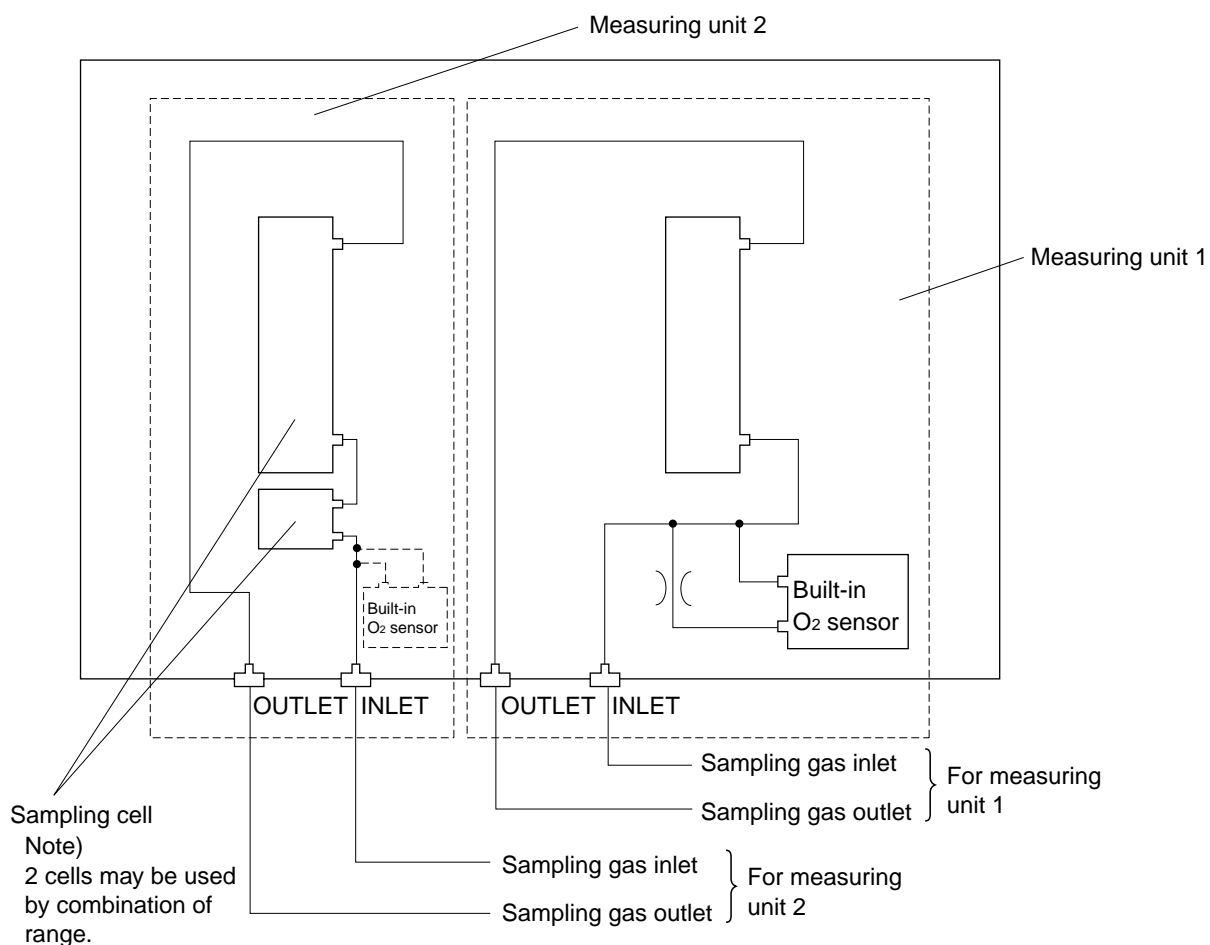


**Sampling gas inlet:** Attach the gas tube to introduce gas to be measured such as one that has completed dehumidification process and standard gases for zero and span calibration to this inlet.  
Gas flow to be introduced should be constant within the range of 0.5 L/min  $\pm$  0.2 L/min.

**Sampling gas outlet:** Exhaust measured gas through the outlet. Attach the tube to exhaust measured gas outdoors or to the atmosphere.

**Purge gas inlet:** It is used for purging the inside of the total gas analyzer. When the analyzer must be purged, refer to Item 3.3.4 Purging of instrument inside.  
Use dry gas N<sub>2</sub> or instrumentation air for purge gas. (flow rate of 1L/min or more).

## Internal piping diagram



Note) When the purge gas inlet is provided, the piping to measuring unit 2 is built inside.

### Correspondence of measured components and measuring units

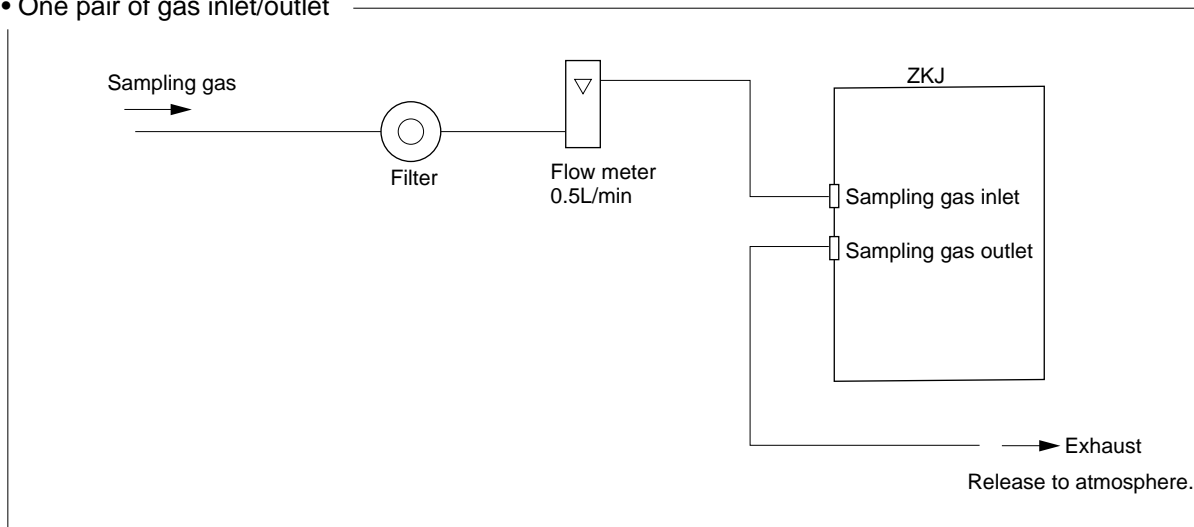
Measured components	Measuring unit 1	Measuring unit 2
1-component analyzer for NO, SO <sub>2</sub> , CO <sub>2</sub> , CO, CH <sub>4</sub> or N <sub>2</sub> O	Each measured component	None
2-component analyzer for NO/SO <sub>2</sub> , CO <sub>2</sub> /CO, N <sub>2</sub> O/CO <sub>2</sub>	NO/SO <sub>2</sub> , CO <sub>2</sub> /CO, N <sub>2</sub> O/CO <sub>2</sub>	None
2-component analyzer for NO/CO	NO	CO
3-component analyzer for NO/SO <sub>2</sub> /CO, N <sub>2</sub> O/CO <sub>2</sub> /CO	NO/SO <sub>2</sub> , N <sub>2</sub> O/CO <sub>2</sub>	CO
3-component analyzer for NO/N <sub>2</sub> O/CO <sub>2</sub> , SO <sub>2</sub> /N <sub>2</sub> O/CO <sub>2</sub> , CH <sub>4</sub> /N <sub>2</sub> O/CO <sub>2</sub>	NO, SO <sub>2</sub> , CH <sub>4</sub>	N <sub>2</sub> O/CO <sub>2</sub>
3-component analyzer for NO/SO <sub>2</sub> /CO	NO/SO <sub>2</sub>	CO
4-component analyzer for NO/SO <sub>2</sub> /CO <sub>2</sub> /CO, NO/SO <sub>2</sub> /N <sub>2</sub> O/CO <sub>2</sub>	NO/SO <sub>2</sub>	CO <sub>2</sub> /CO, N <sub>2</sub> O/CO <sub>2</sub>

Note) When there are two measuring units, the built-in O<sub>2</sub> sensor must be connected to the measuring unit 2.

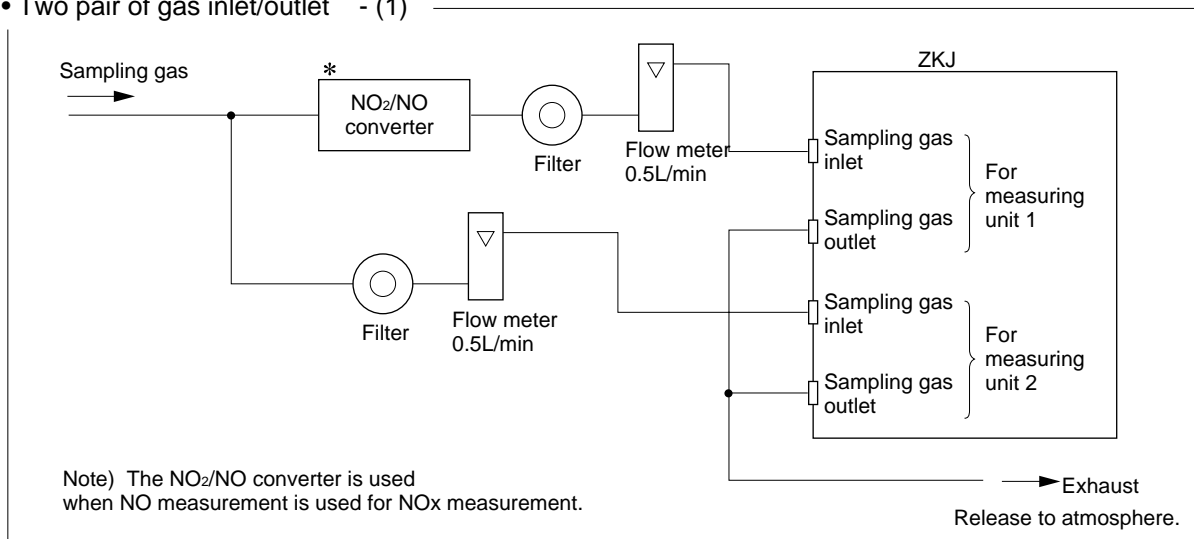


## Example of connecting each measuring unit

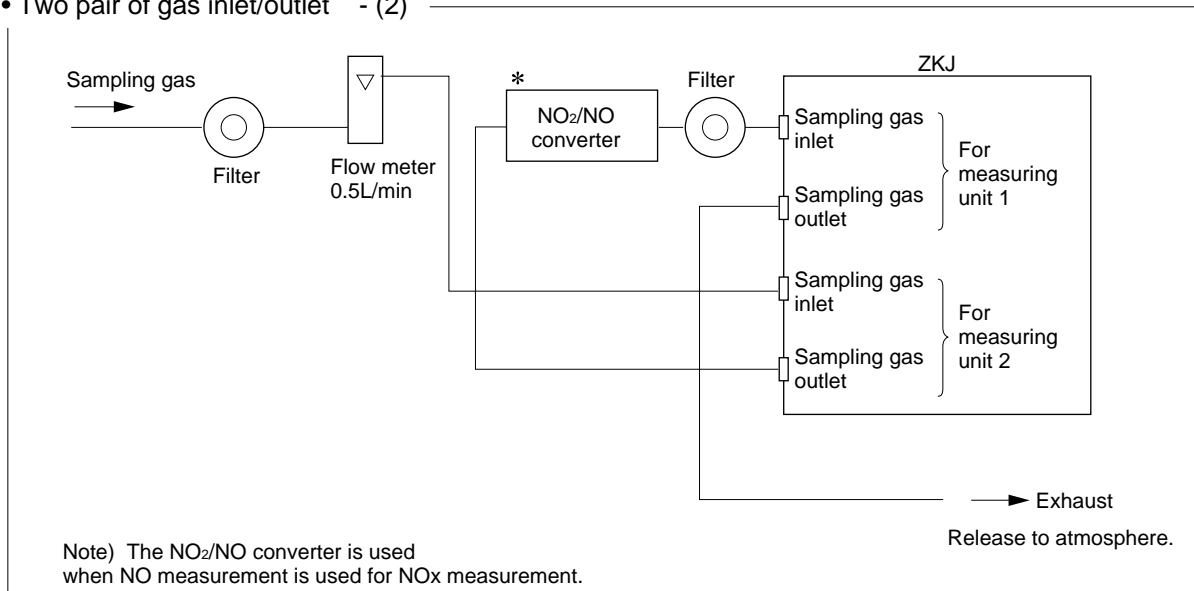
### • One pair of gas inlet/outlet



### • Two pair of gas inlet/outlet - (1)



### • Two pair of gas inlet/outlet - (2)



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## 3.4 Sampling

### 3.4.1 Conditions of sampling gas

- (1) Dust contained in the sampling gas should be completely removed with a filter. For the final stage filter, use a filter that allows removing dust particles of 0.3 $\mu$ m.
- (2) Dew point of sampling gas must be lower than the ambient temperature to avoid occurrence of drain in the gas analyzer. If vapor is contained in the sampling gas, dew point should be lowered to 0°C by using a dehumidifier.
- (3) If SO<sub>3</sub> mist is contained in the sampling gas, use a mist filter or cooler to remove SO<sub>3</sub> mist. Other mists should be removed by using a mist filter or cooler.
- (4) Corrosive gases such as Cl<sub>2</sub>, F<sub>2</sub> and HCl, if they are contained in the sampling gas in considerable amounts, will shorten the life of instruments.
- (5) Temperature of sampling gas should be within 0 to 50°C. Provide a means that prevents entry of hot gas directly into the instrument.

### 3.4.2 Sampling gas flow

Flow of sampling gas should be 0.5L/min  $\pm$  0.2L/min.

Avoid flow fluctuation during measurement.

Observe the flow reading by a flowmeter provided as shown in the example of the sampling system configuration (Item 3.4.6).

### 3.4.3 Preparation of standard gas

Routine calibration is required by standard gas for keeping this instrument under normal operation condition (once a week). Prepare a standard gas cylinder for zero calibration and span calibration.

	Analyzer without O <sub>2</sub> measurement	Analyzer with built-in O <sub>2</sub> sensor	Analyzer with external zirconia O <sub>2</sub> sensor
Zero gas	N <sub>2</sub> gas	N <sub>2</sub> gas	Dry air
Span gas other than for O <sub>2</sub> measurement	Gas with concentration of 90% or more of full scale	Gas with concentration of 90% or more of full scale	Gas with concentration of 90% or more of full scale
Span gas for O <sub>2</sub> measurement	_____	Gas with concentration of 90% or more of full scale or atmospheric air (21%)	1 to 2% O <sub>2</sub>

### 3.4.4 Purging of instrument inside

The inside of instrument need not be purged generally except for the following cases.

- (1) A combustible gas component is contained in sample gas.
- (2) Corrosive gas is contained in the atmospheric air at the installation site.
- (3) The same gas as the sample gas component is contained in the atmospheric air at the installation site.

In such cases as above, the inside of analyzer should be purged with the air for instrumentation or N<sub>2</sub>.

Purging flow rate should be about 1L/min.

If dust or mist is contained in purging gas, it should be eliminated completely in advance.

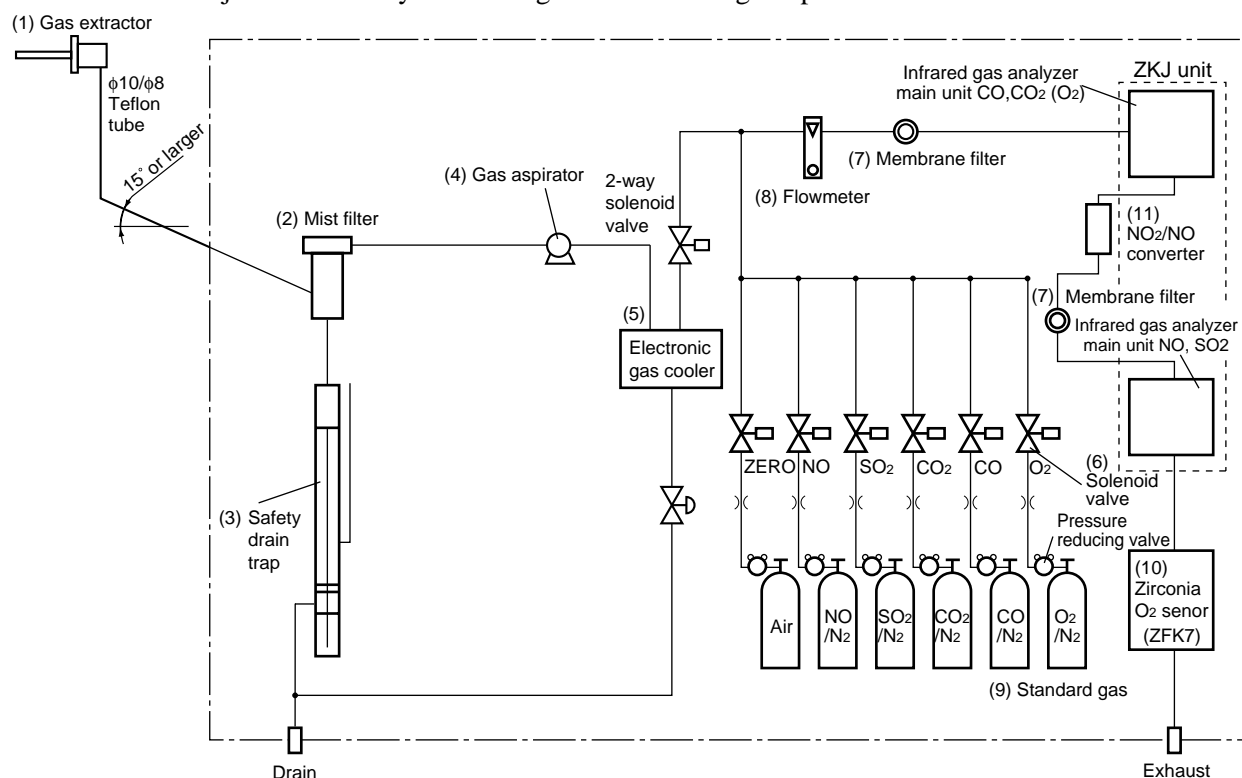
### 3.4.5 Pressure at sampling gas outlet

Pressure at the sampling gas outlet should be adjusted to atmospheric pressure.

### 3.4.6 Example configuration of gas sampling system

The following illustrates a typical system configuration for five component gas measurement for monitoring combustion exhaust gas from boiler, refuse incinerator, etc.

Contact Fuji Electric for system configuration matching the particular use or further information.



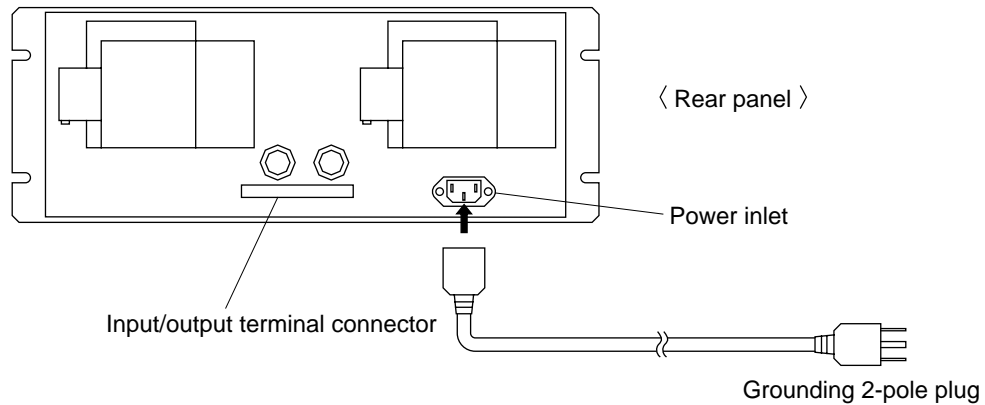
Name	Description	Name	Description
(1) Gas extractor	Gas extractor with a heating type stainless steel filter of standard mesh 40 $\mu$ m	(8) Flowmeter	Adjusts and monitors the flow rate of sample gas.
(2) Mist filter	Removes drain, mist, and dust.	(9) Standard gas	Reference gas used for calibrating zero and span of the analyzer. Total 6 cylinders required for zero gas air, span gas NO, SO <sub>2</sub> , CO, CO <sub>2</sub> and O <sub>2</sub> .
(3) Safety drain trap	The safety drain trap divided into two rooms for positive and negative pressure. It monitors and adjusts the sample gas pressure.	(10) Zirconia O <sub>2</sub> sensor	External zirconia oxygen sensor used for measuring the oxygen concentration in sample gas. (This is not necessary in case when O <sub>2</sub> sensor is built-in.)
(4) Gas aspirator	For aspiration of sample gas	(11) NO <sub>2</sub> /NO converter	Added to NO <sub>x</sub> analyzer. A special catalyst material for efficient conversion of NO <sub>2</sub> gas to NO is used.
(5) Electronic gas cooler	Dries the moisture in sample gas to a dew point of approx. 2°C.		
(6) Solenoid valve	Used for introducing calibration gas.		
(7) Membrane filter	PTFE filter used to eliminate fine dust particles and permit monitoring of dust adhering condition on the front panel of the gas analyzer.		

## 3.5 Wiring

### 3.5.1 Power inlet

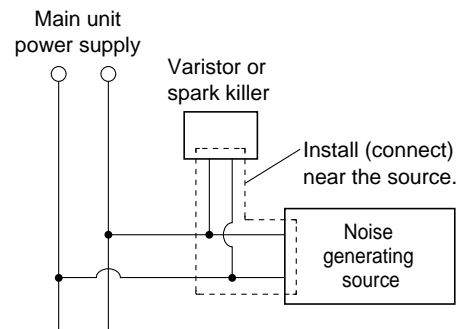
The power inlet is provided at the rear panel.

Connect supplied power cable to this power inlet.



#### When noise source is in the vicinity

- Avoid installing this instrument near an electrical unit (high frequency furnace or electric welder) that generates much electrical noise. If using the instrument near such a noise generating unit is unavoidable, use a different power line to avoid noise.
- Mount a noise suppressor such as varistor or spark killer as shown at right figure to the noise generating unit when noise is generated from relays or solenoid valves. Mount the suppressor near the noise generating source, or it will have no effect.

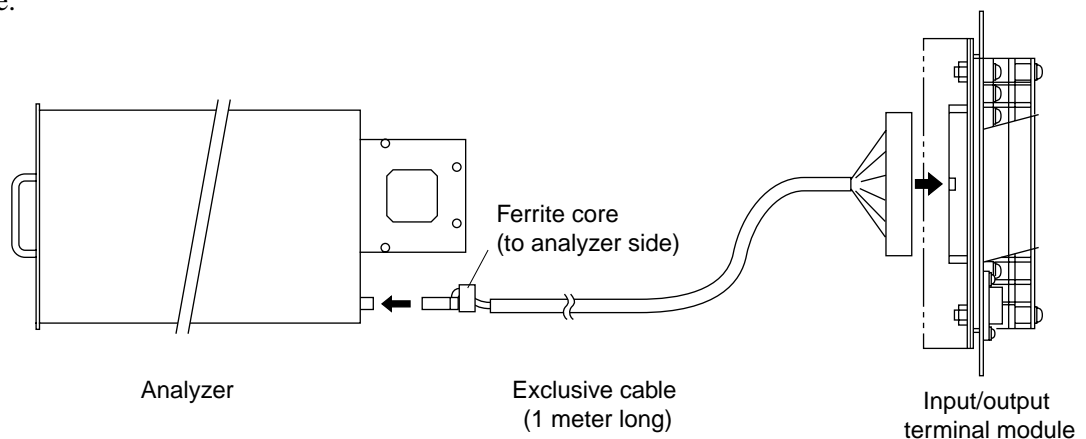


### 3.5.2 Input/output terminal module

This analyzer should be connected to the input/output terminal module by supplied exclusive cable.

Plug this cable connector into the receptacle at the rear panel of the analyzer and the receptacle on the PC board of the input/output module.

Connect the exclusive cable so that the ferrite core attached to the cable comes to the analyzer side.



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**(1) Analog output signal (AO):** terminal block 1 (1) to (20), terminal block 2 (3) to (6)

Output signal : 4 to 20 mADC or 0 to 1 VDC (selected when ordering)

Non-insulated output

Allowable load : 4 to 20 mADC, 550Ω or less

0 to 1 VDC, 100kΩ or more

- Analog output is provided from each terminal corresponding to the channel displayed in the measurement screen.

All of analog output signals for the instrument are not isolated. It is recommended to isolate signals individually to prevent interference from unnecessary signals or to prevent external interference, especially leading the cable of more than 30 meters or to outdoor.

**(2) O<sub>2</sub> sensor input:** terminal block 2 (1) – (2)

Input signal:

External zirconia O<sub>2</sub> analyzer : Zirconia O<sub>2</sub> sensor signal (Fuji ZFK7 output)

External O<sub>2</sub> analyzer : 0 to 1 VDC (DC input resistor of 1MΩ or more)

- It is used when the external zirconia O<sub>2</sub> analyzer or external O<sub>2</sub> analyzer is specified as order.
- To connect to the output of the external Zirconia analyzer or external O<sub>2</sub> analyzer prepared separately.
- In case of an external O<sub>2</sub> analyzer, input a signal of 0 to 1 VDC with respect to O<sub>2</sub> full scale of the analyzer.
- In case of built-in O<sub>2</sub> analyzer, do not use the terminals.

O<sub>2</sub> sensor input is not isolated. It is recommended to isolate when an external O<sub>2</sub> analyzer is installed apart from this analyzer. Zirconia O<sub>2</sub> sensor Fuji make ZFK7 should be installed at a location that is as close to this instrument as possible.

**(3) Contact input (DI):** terminal block 2 (11) to (20), terminal block 3 (5) to (10)

- It is for a contact input at no voltage. An input is provided when switching to short circuit (on) or open (off).
- No voltage is applied to the terminals.

**(4) Contact output (DO):** terminal block 3 (11) to (20), terminal block 4 and terminal block 5

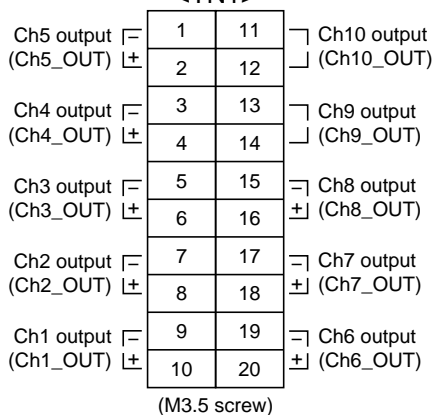
- Contact rating: 250VAC/2A, load resistance
- An output is for a relay contact output. An output is provided when switching to conductive (on) or open (off).

Wiring of analog output signal, O<sub>2</sub> sensor input and contact input should be fixed separately from the wiring of power supply and contact output.

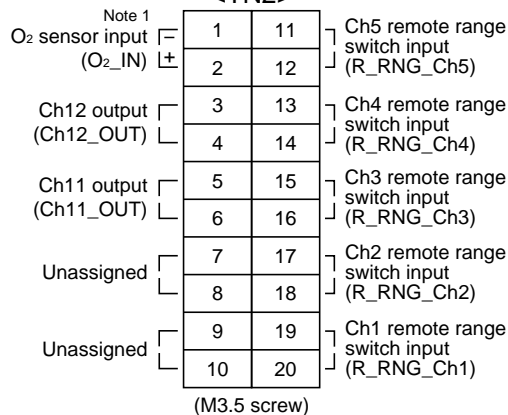
**Note) To avoid the effect of noise generated from external units, be sure to ground the analyzer main unit. Continue between the I/O module mounting plate and the panel and connect the panel casing to the same ground as the analyzer.**

## (5) List of terminal blocks

Terminal block 1  
<TN1>

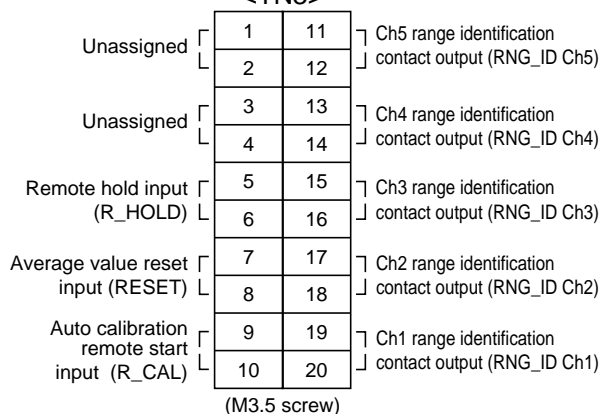


Terminal block 2  
<TN2>

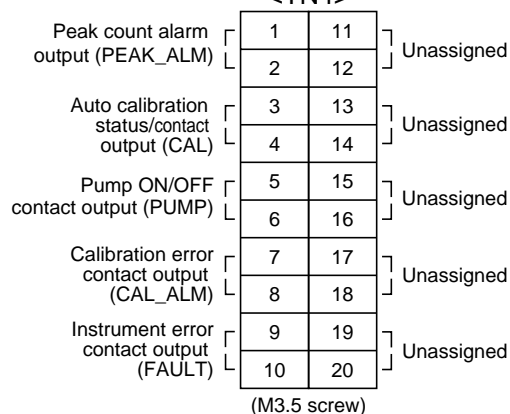


Note 1 : For external O<sub>2</sub> sensor input.

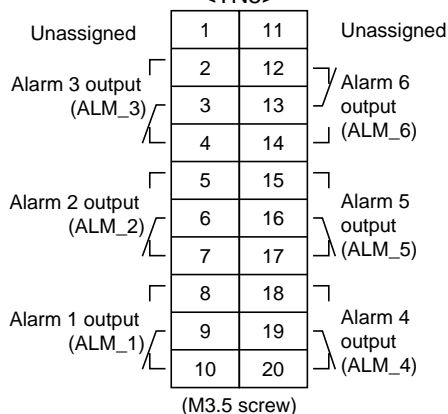
Terminal block 3  
<TN3>



Terminal block 4  
<TN4>

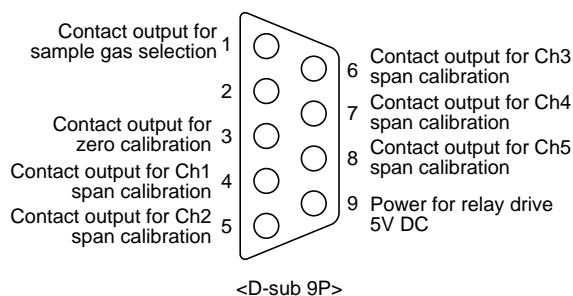


Terminal block 5  
<TN5>



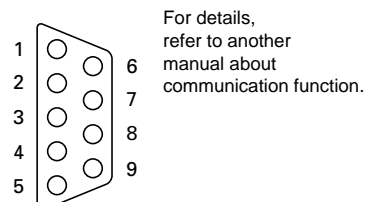
Connector  
<CN3>

Solenoid valve drive signal output for calibration (Transister output)



Connector  
<CN2>

For serial communication (D-Sub9pin)





## (6) Description on terminal block

Terminal block 1  
<TN1>

Ch5 output (Ch5_OUT)	1	11	Ch10 output (Ch10_OUT)
	2	12	
Ch4 output (Ch4_OUT)	3	13	Ch9 output (Ch9_OUT)
	4	14	
Ch3 output (Ch3_OUT)	5	15	Ch8 output (Ch8_OUT)
	6	16	
Ch2 output (Ch2_OUT)	7	17	Ch7 output (Ch7_OUT)
	8	18	
Ch1 output (Ch1_OUT)	9	19	Ch6 output (Ch6_OUT)
	10	20	

(M3.5 screw)

### Terminal block 1 <TN1>

Terminal block for analog output (non-isolated output)

Between 1–2 : Ch5 output

Between 3–4 : Ch4 output

Between 5–6 : Ch3 output

Between 7–8 : Ch2 output

Between 9–10 : Ch1 output

Between 11–12 : Ch10 output

Between 13–14 : Ch9 output

Between 15–16 : Ch8 output

Between 17–18 : Ch7 output

Between 19–20 : Ch6 output

Terminal block 2  
<TN2>

Note 1 O <sub>2</sub> sensor input (O <sub>2</sub> _IN)	1	11	Ch5 remote range switch input (R_RNG_Ch5)
	2	12	
Ch12 output (Ch12_OUT)	3	13	Ch4 remote range switch input (R_RNG_Ch4)
	4	14	
Ch11 output (Ch11_OUT)	5	15	Ch3 remote range switch input (R_RNG_Ch3)
	6	16	
Unassigned	7	17	Ch2 remote range switch input (R_RNG_Ch2)
	8	18	
Unassigned	9	19	Ch1 remote range switch input (R_RNG_Ch1)
	10	20	

(M3.5 screw)

### Terminal block 2 <TN2>

Between 1–2 : O<sub>2</sub> sensor input

(For input of Fuji's zirconia oxygen sensor or externally oxygen sensor. Must not be used unless external O<sub>2</sub> sensor is provided.)

Between 3–4 : Ch12 output

Between 5–6 : Ch11 output

Between 7–10 : For internal connection. Must not be wired. (Must not be used as junction terminal).

Between 11–12: Ch5 remote range switch input

Between 13–14: Ch4 remote range switch input

Between 15–16: Ch3 remote range switch input

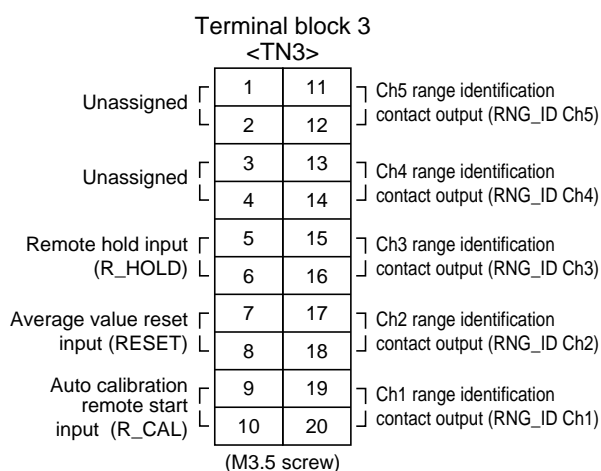
Between 17–18: Ch2 remote range switch input

Between 19–20: Ch1 remote range switch input

Note 1: For external O<sub>2</sub> sensor input.

#### Action of remote range switch

High range is selected when open. Low range is selected when short-circuited. For details of action, see "Item 6.1 Switch of range."



### Terminal block 3 <TN3>

Between 1–4 : For internal connection. Must not be wired. (Must not be used as junction terminal.)

Between 5–6 : Remote hold input. No hold when open. Output hold when short-circuited.

For details, refer to “Item 6.7  
Parameter setting, Output Hold”.

Between 7–8 : Average value reset input. short-circuiting the contact input (for at 1.5 sec min.) resets O<sub>2</sub> average and O<sub>2</sub> converted average simultaneously. Opening it restarts the average value.

For details, refer to “Item 6.7  
Parameter setting, Average Value Resetting”

Between 9–10 : Automatic calibration remote start input

After shorting for 1.5 sec. or more, automatic calibration is started by the opening input whether the automatic calibration setting is ON/OFF.

For details, refer to “Item 6.4  
Setting of auto calibration”

Between 11–12: Ch5 range identification contact output

Between 13–14: Ch4 range identification contact output

Between 15–16 Ch3 range identification contact output

Between 17–18: Ch2 range identification contact output

Between 19–20: Ch1 range identification contact output

Action of range identification signal  
Range identification contact is conductive at low range and open at high range.

---

Terminal block 4 <TN4>		
Peak count alarm output (PEAK_ALM)	1	11
	2	12
Auto calibration status/contact output (CAL)	3	13
	4	14
Pump ON/OFF contact output (PUMP)	5	15
	6	16
Calibration error contact output (CAL_ALM)	7	17
	8	18
Instrument error contact output (FAULT)	9	19
	10	20
(M3.5 screw)		

#### Terminal 4 <TN4>

Between 1–2 : Peak count alarm contact output  
It is conductive when peak count exceeds the setting time. It remains open below the setting time. For setting and operation, refer to “Item 6.6 Peak alarm setting”.

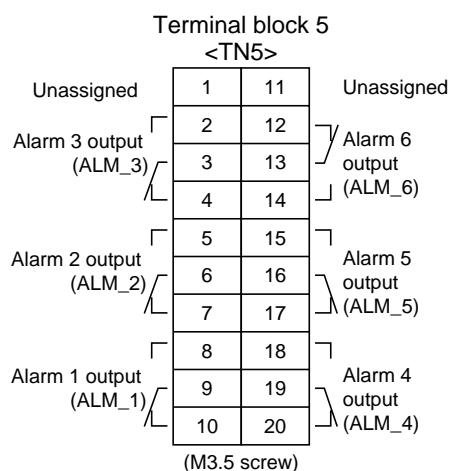
Between 3–4 : Contact output of auto calibration status  
When the auto calibration is carried out , it is conductive. Remains open otherwise.

Between 5–6 : Pump ON/OFF contact output  
Used when turning ON/OFF the pump. It is open during auto and manual calibration status and conductive during measurement.

Between 7–8 : Calibration error contact output  
It is conductive when an error occurs during zero calibration or span calibration. It is normally open.

Between 9–10 : It is conductive when an error occurs to the analyzer unit. It is normally open.

Between 11–20: For internal connection, wiring is not allowed. (Do not use it as junction terminal).



### Terminal 5 <TN5>

Between 2, 3 and 4 : Alarm 3 output  
When the output exceeds the set value, it is conductive between 2 and 3, and open between 3 and 4. Otherwise, it is open between 2 and 3 and conductive between 3 and 4.

Between 5, 6 and 7 : Alarm 2 output  
When the output exceeds the set value, it is conductive between 5 and 6, and open between 6 and 7. Otherwise, it is open between 5 and 6, and conductive between 6 and 7.

Between 8, 9 and 10 : Alarm 1 output  
When the output exceeds the set value, it is conductive between 8 and 9, and open between 9 and 10. Otherwise, it is open between 8 and 9.

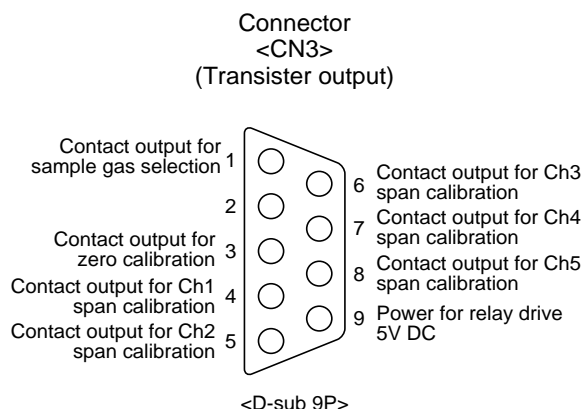
Between 12, 13 and 14: Alarm 6 output  
When the analyzer unit is turned ON, it is conductive between 12 and 13, and open between 13 and 14. When the analyzer unit is turned OFF, it is open between 12 and 13, and conductive between 13 and 14.

Between 15, 16 and 17: Alarm 5 output  
When the output exceeds the set value, it is conductive between 15 and 16, and open between 16 and 17. Otherwise, it is open between 15 and 16, and conductive between 16 and 17.

Between 18, 19 and 20: Alarm 4 output  
When the output exceeds the set value, it is conductive between 18 and 19, and open between 19 and 20. Otherwise, it is open between 18 and 19, and conductive between 19 and 20.  
For detailed action of the alarm contact, refer to “Item 6.3 Alarm setting”.

## Connector <CN3>

Solenoid valve drive signal output for calibration



Connector <CN3> provides outputs in combination with calibration action during auto calibration and manual calibration.

An output is from a transistor (ratings: 5V/50mA).

A transistor is turned ON before starting each calibration.

Sample selection output is ON during measurement and OFF during calibration.

If calibration is not performed, the other transistors are OFF.

In case of auto calibration, sequential output is ON/OFF according to the setting.

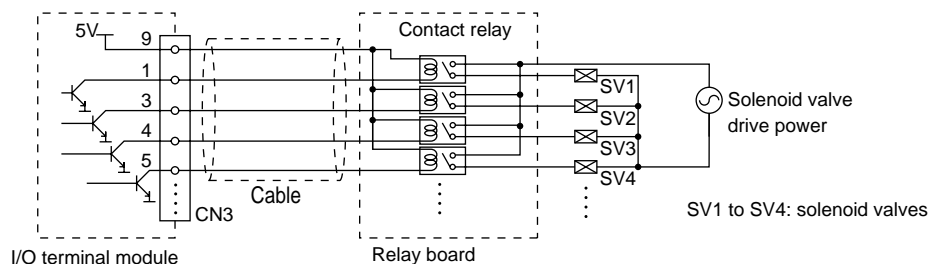
Refer to “Item 6.4 Setting of auto calibration”.

**Note) No. 9 pin is for solenoid valve ON/OFF relay drive power (5V DC/0.5A, max).**

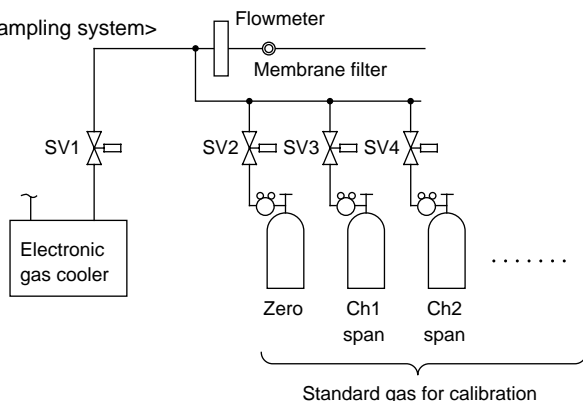
**Use No. 9 with reference to the diagram.**

Example of using solenoid valve drive signal output for calibration

<Electrical system>



<Gas sampling system>

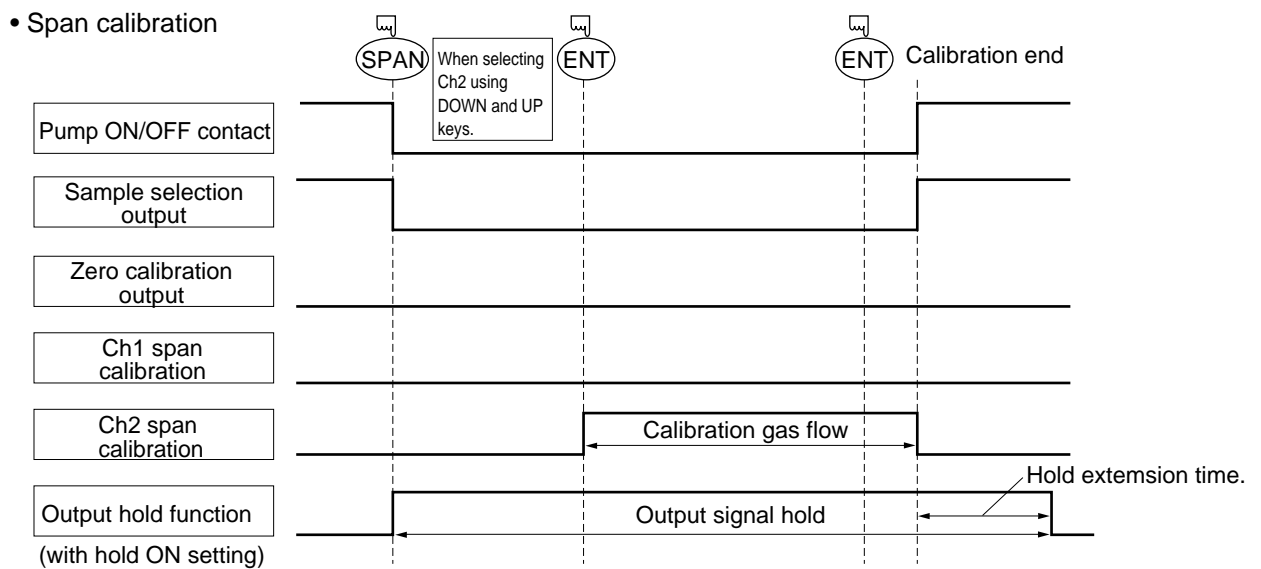
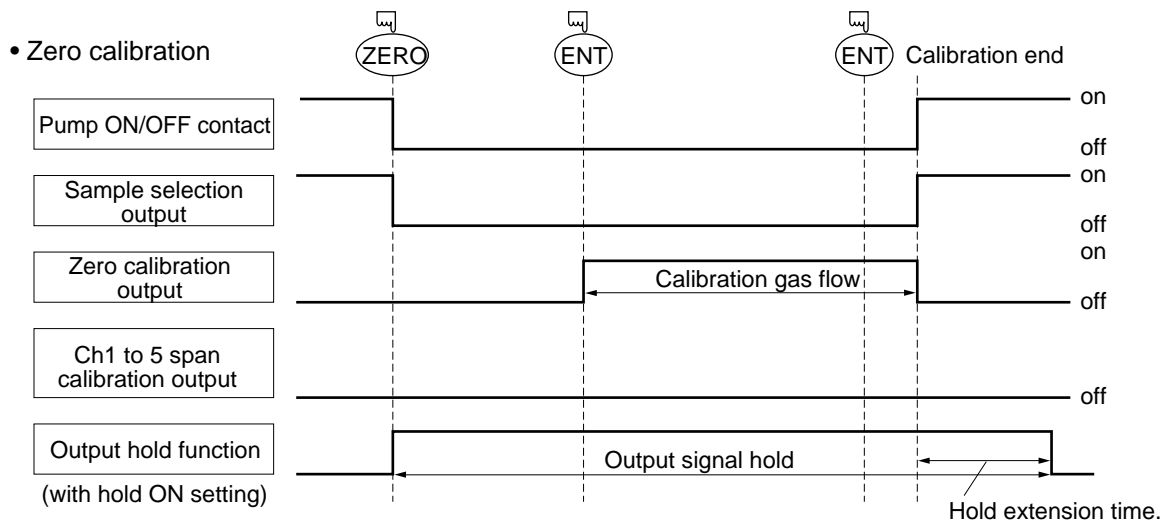


Refer to “Item 3.4.6 Example configuration of gas sampling system”.

Relay board and exclusive cable (D-sub 9p straight cable: 1.5 meters) are available on request.

## (7) Timing of solenoid valve drive signal for calibration

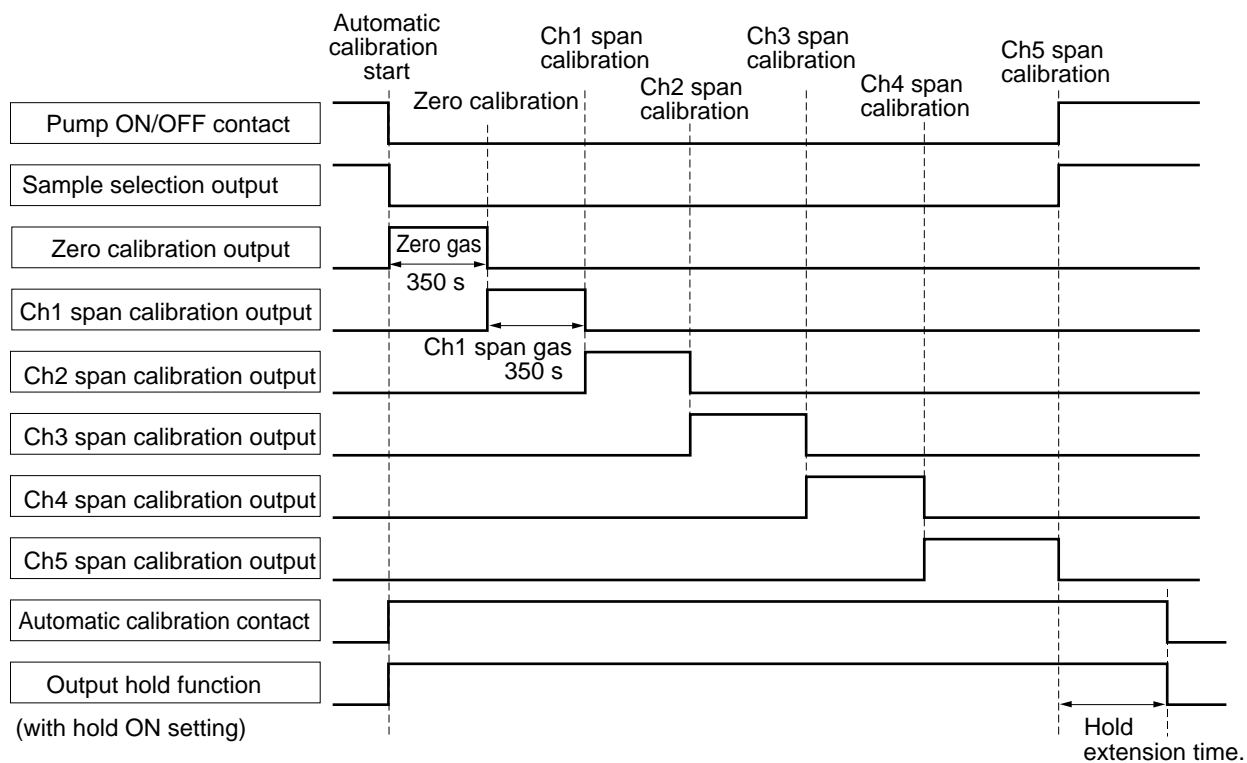
### 1) Manual calibration (See “Item 6.9 Calibration”.)



Note) The hold extension time depends on the gas flow time of the automatic calibration settings.



**2) In case of automatic calibration (example shown in Item 6.4.1, Automatic calibration settings)**



## 4. OPERATION

---

### 4.1 Preparation for operation

#### (1) Tube and wiring check

Double-check if tubes of the gas sampling and exhaust ports are correctly connected.

Double-check for proper wiring.

### 4.2 Warm-up operation and regular operation

#### (1) Operation procedure

- 1) Turn ON the power switch on the front panel of the analyzer unit.  
The measurement screen appears on the front display panel in 1 or 2 seconds.
- 2) Wait for about 4 hours until the instrument is warmed up.  
About 4 hours are required until the instrument allows accurate measurement.

**Note) When in warm-up, the concentration reading may be beyond.**

upper limit of range or

lower limit of range.

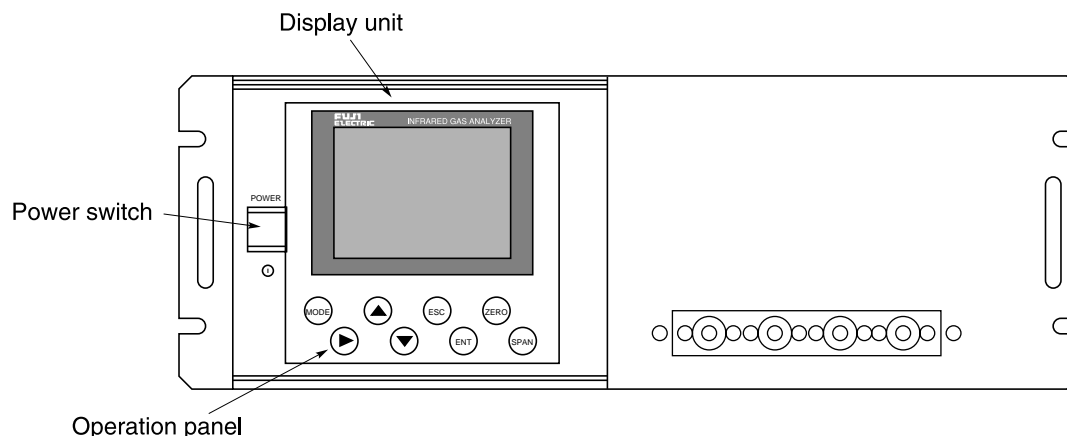
**But, it is not an error.**

- 3) Setting of various set values  
Perform the various settings according to “Chapter 6. Setting and Calibration”.
- 4) Zero calibration and span calibration  
Perform zero calibration and span calibration after warm-up operation.  
Refer to “Chapter 6.9. Calibration”.
- 5) Introduction and measurement of measuring gas  
Introduce the measuring gas into the analyzer unit before starting measurement.

## 5. DESCRIPTION OF DISPLAY AND OPERATION PANELS

This section describes the display unit and operation panel of the analyzer unit. It also explains the name and description of function on the operation panel.

### 5.1 Name and description of operation panel



- Display unit: The measurement screen and the setting items are displayed.
- Operation panel: The configuration is as shown below.

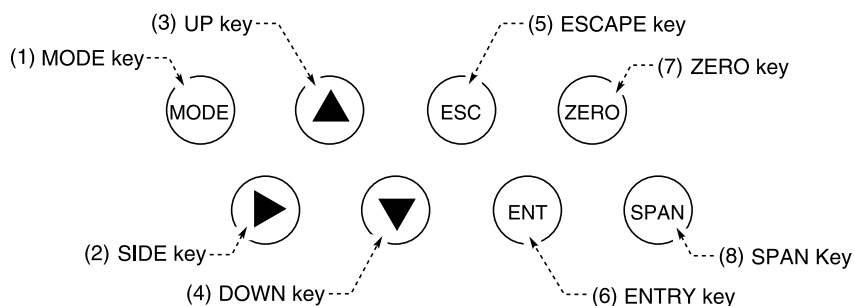


Fig. 5-1

Name	Description	Name	Description
(1) MODE key	Used to switch the mode.	(5) ESC key	Used to return to a previous screen or cancel the setting midway.
(2) SIDE key	Used to change the selected item (by moving the cursor) and numeral digit.	(6) ENT key	Used for confirmation of selected items or values, and for execution of calibration.
(3) UP key	Used to change the selected item (by moving the cursor) and to increase numeral value.	(7) ZERO key	Used for zero calibration.
(4) DOWN key	Used to change the selected item (by moving the cursor) and to decrease numeral value.	(8) SPAN key	Used for span calibration.

## 5.2 Overview of display and operation panels

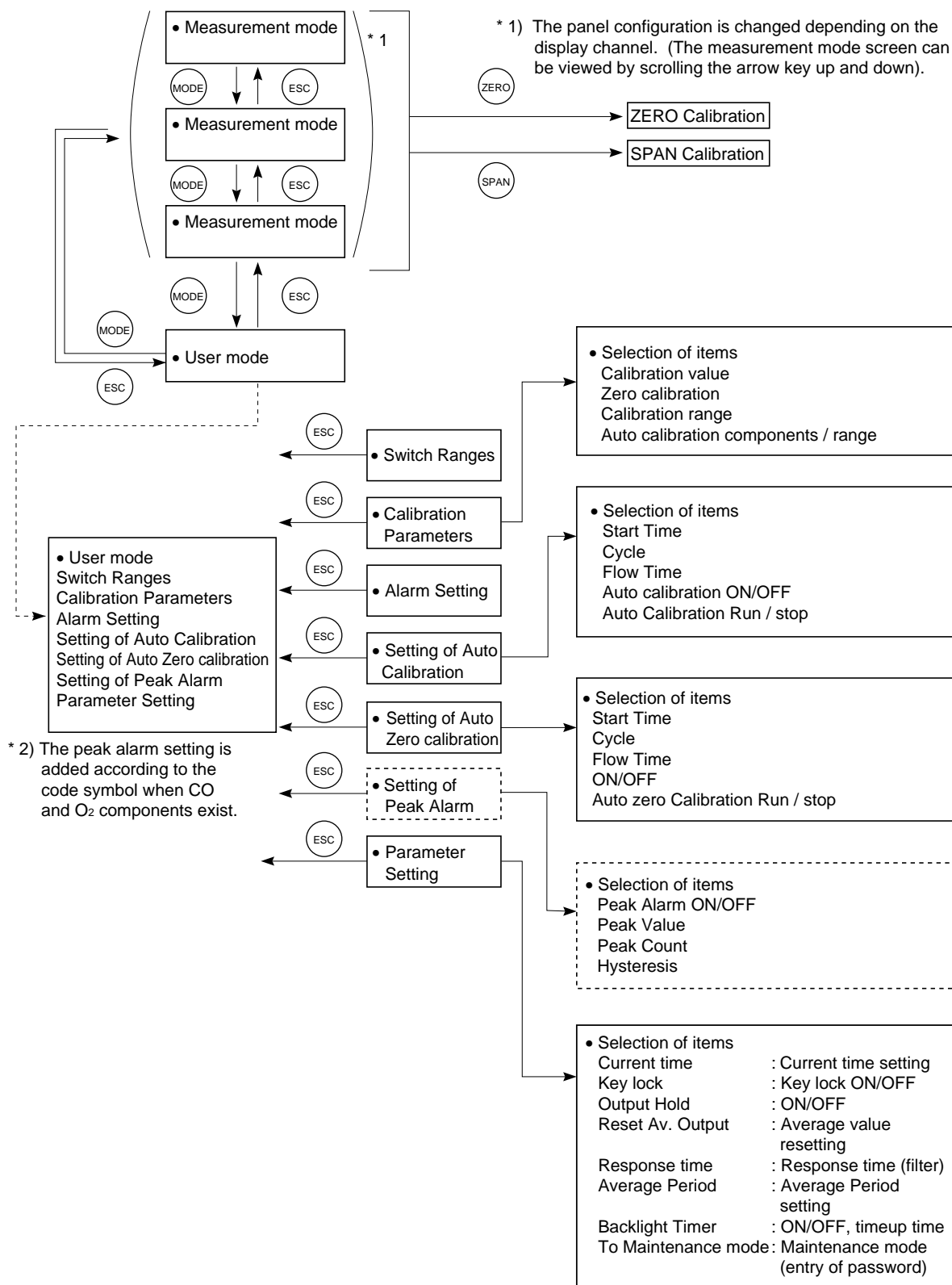


Fig. 5-2

### 5.3 Outline of display screen

#### (1) Measurement mode screen (appears when the power is turned ON)

The measurement screen depends on the number of components. The following screen configuration as shown as an example is for NO, SO<sub>2</sub>, CO<sub>2</sub>, CO and O<sub>2</sub> (output: 12 channel).

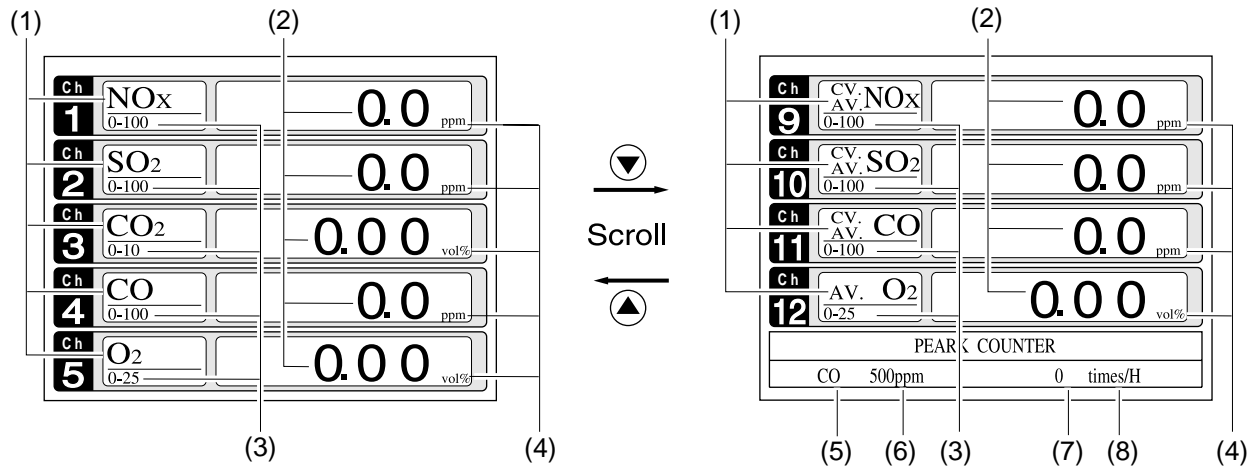


Fig. 5-3 Name and function of measurement mode screen

\* For outputs of more than 5 channels, scroll the arrow key (▲) or (▼) to view.

No.	Name	Function	No.	Name	Description
(1)	Component display	Displays component of instantaneous value, converted instantaneous value, converted average value, etc.	(5)	Peak alarm component display	Displays peak alarm component.
(2)	Concentration display	Displays measured value of concentration.	(6)	Peak alarm concentration display	Displays peak alarm concentration display. (Upper limit value)
(3)	Range display	Displays range values.	(7)	Peak alarm times	Displays the alarm times exceeding the peak value.
(4)	Unit display	Displays unit with ppm and vol%.	(8)	Peak alarm unit display	Displays units of peak alarm with times/H.

- **Instantaneous value and concentration value:**

The concentration display of Ch (component) where sampling components such as “CO<sub>2</sub>”, “CO” or “O<sub>2</sub>” are displayed in the component display, indicates current concentration values of the measured components contained in gas that is now under measurement.

- **O<sub>2</sub> conversion concentration values:**

Ch components where “cv\*\*” is displayed as “cv CO” in the component display are calculated from the following equation, by setting sampling components, O<sub>2</sub> instantaneous/concentration values and O<sub>2</sub> conversion reference value (see item 6.8).

$$\text{Conversion output} = \frac{21 - \text{On}}{21 - \text{Os}} \times \text{Cs}$$

On: The value of the O<sub>2</sub> conversion reference value (Value set by application)

Os: Oxygen concentration (%)

Cs: Concentration of relevant measured component.  
Note that Os does not exceed the O<sub>2</sub> limit value set in “Other Parameter” in “6.8 Maintenance mode.”

The converted sampling components are NO<sub>x</sub>, SO<sub>2</sub> and CO only.

- **O<sub>2</sub> conversion concentration average value:**

In the Ch (component) and O<sub>2</sub> average value where “<sup>CV</sup><sub>AV</sub>\*\*\*” is displayed as “<sup>CV</sup><sub>AV</sub>CO” in the component display, a value obtained by averaging O<sub>2</sub> conversion concentration value or O<sub>2</sub> average value in a fixed time is output every 30 seconds.

Averaging time can be changed between 1 minute and 59 minutes or 1 hour and 4 hours according to the average time settings (See 6.7, Parameter setting).

(The set time is displayed as “1h”, for instance, in the range display.)

\* The measurement ranges of O<sub>2</sub> conversion concentration value and O<sub>2</sub> conversion concentration average value are the same as that of the measuring components. Also, the measurement range of O<sub>2</sub> average value is the same as that of O<sub>2</sub>.

## (2) Setting/selection screen

The setting/selection screen is configured as shown below:

- In the status display area, the current status is displayed.
- In the message display area, messages associated with operation are displayed.
- In the setting item and selection item display area, items or values to be set are displayed, as required. To work on the area, move the cursor to any item by using UP, DOWN and SIDE keys.

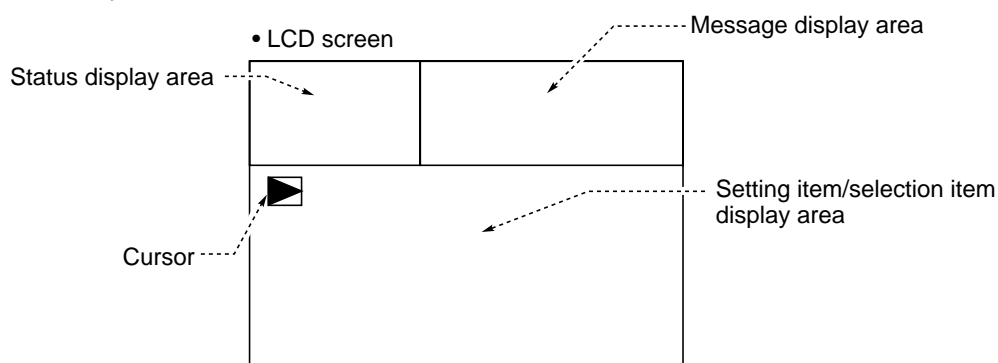


Fig. 5-4

### (3) Contents of measured channel (Ch)

The following table gives measurement channels and their contents according to the symbols.

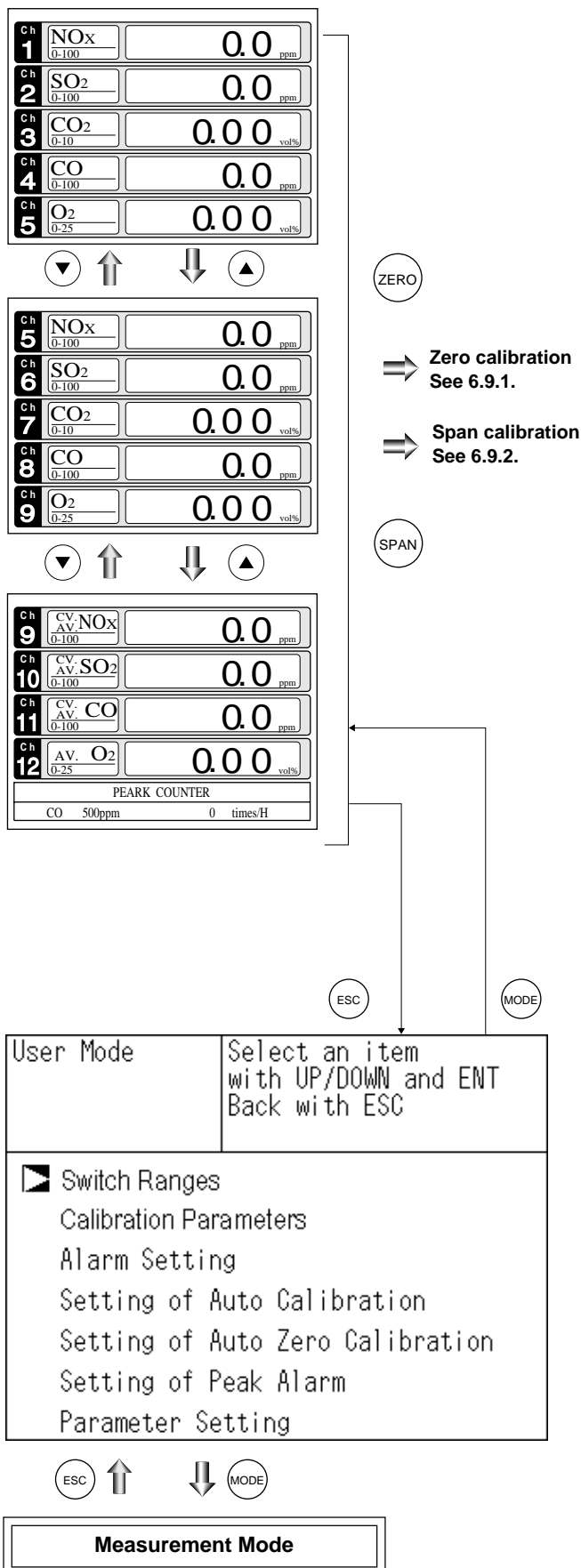
Code symbol			Contents
5th digit	6th digit	22nd digit	
P	Y	Y	Ch1: NO
A	Y	Y	Ch1: SO <sub>2</sub>
D	Y	Y	Ch1: CO <sub>2</sub>
B	Y	Y	Ch1: CO
E	Y	Y	Ch1: CH <sub>4</sub>
F	Y	Y	Ch1: NO, Ch2: SO <sub>2</sub>
H	Y	Y	Ch1: NO, Ch2: CO
G	Y	Y	Ch1: CO <sub>2</sub> , Ch2: CO
L	Y	Y	Ch1: NO, Ch2: SO <sub>2</sub> , Ch3: CO
M	Y	Y	Ch1: NO, Ch2: SO <sub>2</sub> , Ch3: CO <sub>2</sub> , Ch4: CO
P	A, B, C	A	Ch1: NO <sub>x</sub> , Ch2: O <sub>2</sub> , Ch3: Converted NO <sub>x</sub> , Ch4: Converted NO <sub>x</sub> average, Ch5: O <sub>2</sub> average
A	A, B, C	A	Ch1: SO <sub>2</sub> , Ch2: O <sub>2</sub> , Ch3: Converted SO <sub>2</sub> , Ch4: Converted SO <sub>2</sub> average, Ch5: O <sub>2</sub> average
B	A, B, C	A	Ch1: CO, Ch2: O <sub>2</sub> , Ch3: Converted CO, Ch4: Converted CO average, Ch5: O <sub>2</sub> average
F	A, B, C	A	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: O <sub>2</sub> , Ch4: Converted NO <sub>x</sub> , Ch5: Converted SO <sub>2</sub> , Ch6: Converted NO <sub>x</sub> average, Ch7: Converted SO <sub>2</sub> average, Ch8: O <sub>2</sub> average
H	A, B, C	A	Ch1: NO <sub>x</sub> , Ch2: CO, Ch3: O <sub>2</sub> , Ch4: Converted NO <sub>x</sub> , Ch5: Converted CO, Ch6: Converted NO <sub>x</sub> average, Ch7: Converted CO average, Ch8: O <sub>2</sub> average
G	A, B, C	A	Ch1: CO <sub>2</sub> , Ch2: CO, Ch3: O <sub>2</sub> , Ch4: Converted CO, Ch5: Converted CO average, Ch6: O <sub>2</sub> average
L	A, B, C	A	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO, Ch4: O <sub>2</sub> , Ch5: Converted NO <sub>x</sub> , Ch6: Converted SO <sub>2</sub> , Ch7: Converted CO, Ch8: Converted NO <sub>x</sub> average, Ch9: Converted SO <sub>2</sub> average, Ch10: Converted CO average, Ch11: O <sub>2</sub> average
M	A, B, C	A	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO <sub>2</sub> , Ch4: CO, Ch5: O <sub>2</sub> , Ch6: Converted NO <sub>x</sub> , Ch7: Converted SO <sub>2</sub> , Ch8: Converted CO, Ch9: Converted NO <sub>x</sub> average, Ch10: Converted SO <sub>2</sub> average, Ch11: Converted CO average, Ch12: O <sub>2</sub> average
B	A, B, C	B	Ch1: CO, Ch2: O <sub>2</sub>
H	A, B, C	B	Ch1: NO, Ch2: CO, Ch3: O <sub>2</sub>
G	A, B, C	B	Ch1: CO <sub>2</sub> , Ch2: CO, Ch3: O <sub>2</sub>
L	A, B, C	B	Ch1: NO, Ch2: SO <sub>2</sub> , Ch3: CO, Ch4: O <sub>2</sub>
M	A, B, C	B	Ch1: NO, Ch2: SO <sub>2</sub> , Ch3: CO <sub>2</sub> , Ch4: CO, Ch5: O <sub>2</sub>
B	A, B, C	C	Ch1: CO, Ch2: O <sub>2</sub> , Ch3: Converted CO, Ch4: Converted CO average, Ch5: O <sub>2</sub> average
H	A, B, C	C	Ch1: NO <sub>x</sub> , Ch2: CO, Ch3: O <sub>2</sub> , Ch4: Converted NO <sub>x</sub> , Ch5: Converted CO, Ch6: Converted NO <sub>x</sub> average, Ch7: Converted CO average, Ch8: O <sub>2</sub> average
G	A, B, C	C	Ch1: CO <sub>2</sub> , Ch2: CO, Ch3: O <sub>2</sub> , Ch4: Converted CO, Ch5: Converted CO average, Ch6: O <sub>2</sub> average
L	A, B, C	C	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO, Ch4: O <sub>2</sub> , Ch5: Converted NO <sub>x</sub> , Ch6: Converted SO <sub>2</sub> , Ch7: Converted CO, Ch8: Converted NO <sub>x</sub> average, Ch9: Converted SO <sub>2</sub> average, Ch10: Converted CO average, Ch11: O <sub>2</sub> average
M	A, B, C	C	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO <sub>2</sub> , Ch4: CO, Ch5: O <sub>2</sub> , Ch6: Converted NO <sub>x</sub> , Ch7: Converted SO <sub>2</sub> , Ch8: Converted CO, Ch9: Converted NO <sub>x</sub> average, Ch10: Converted SO <sub>2</sub> average, Ch11: Converted CO average, Ch12: O <sub>2</sub> average
Q	Y	Y	Ch1:N <sub>2</sub> O
R	Y	Y	Ch1:N <sub>2</sub> O, Ch2:CO <sub>2</sub>
S	Y	Y	Ch1:NO, Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub>
T	Y	Y	Ch1:SO <sub>2</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub>
U	Y	Y	Ch1:N <sub>2</sub> O, Ch2:CO <sub>2</sub> , Ch3:CO
V	Y	Y	Ch1:CH <sub>4</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub>
W	Y	Y	Ch1:NO, Ch2:SO <sub>2</sub> , Ch3:N <sub>2</sub> O, Ch4:CO <sub>2</sub>
S	A, B, C	Y	Ch1:NO, Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> ,Ch4:O <sub>2</sub>
T	A, B, C	Y	Ch1:SO <sub>2</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> ,Ch4:O <sub>2</sub>
U	A, B, C	Y, B	Ch1:N <sub>2</sub> O, Ch2:CO <sub>2</sub> , Ch3:CO, Ch4:O <sub>2</sub>
V	A, B, C	Y	Ch1:CH <sub>4</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> ,Ch4:O <sub>2</sub>
W	A, B, C	Y	Ch1:NO, Ch2:SO <sub>2</sub> , Ch3:N <sub>2</sub> O, Ch4:CO <sub>2</sub> , Ch5:O <sub>2</sub>
S	A, B, C	A	Ch1:NO <sub>x</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> , Ch4:O <sub>2</sub> , Ch5:Converted NO <sub>x</sub> , Ch6:Converted NO <sub>x</sub> average, Ch7:O <sub>2</sub> average
T	A, B, C	A	Ch1:SO <sub>2</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> ,Ch4:O <sub>2</sub> , Ch5:Converted SO <sub>2</sub> , Ch6:Converted SO <sub>2</sub> average, Ch7:O <sub>2</sub> average
U	A, B, C	A, C	Ch1:N <sub>2</sub> O, Ch2:CO <sub>2</sub> , Ch3:CO, Ch4:O <sub>2</sub> , Ch5:Converted CO, Ch6:Converted CO average, Ch7:O <sub>2</sub> average
V	A, B, C	A	Ch1:CH <sub>4</sub> , Ch2:N <sub>2</sub> O, Ch3:CO <sub>2</sub> ,Ch4:O <sub>2</sub> ,Ch5:O <sub>2</sub> average
W	A, B, C	A	Ch1:NO <sub>x</sub> , Ch2:SO <sub>2</sub> , Ch3:N <sub>2</sub> O, Ch4:CO <sub>2</sub> , Ch5:O <sub>2</sub> , Ch6:Converted NO <sub>x</sub> , Ch7:Converted SO <sub>2</sub> , Ch8:Converted NO <sub>x</sub> average, Ch9:Converted SO <sub>2</sub> average, Ch10:O <sub>2</sub> average



## 5.4 Basic operation

### • Measurement mode

The measurement mode can be displayed up to 5 channels in a single screen. If 5 channels or more are to be displayed in a single screen, press the ▲ or ▼ key to scroll the channel one by one.



### • User mode displays;

Switch Ranges

Calibration Parameters

Alarm Setting

Setting of Auto Calibration

Setting of Auto Zero Calibration

Setting of Peak Alarm

Parameter Setting.







For the setting contents, refer to “Chapter 6. Setting and calibration”.



## 6. SETTING AND CALIBRATION

### 6.1 Switch of range

#### 6.1.1 Setting of range switch mode


Set the range switch mode as follows.


- (1) Press the  key in measurement mode to display the User mode screen.
- (2) Move the cursor to “Switch Ranges” and press the  key.
- (3) The “Channel Selection” screen appears. Move the  cursor by pressing the  or the  key on the channel selection screen that appears, and select Ch (component).
- (4) Then press the  key.


- (5) Selected range switch mode is highlighted.  
Press the  or the  key to select a desired switch mode.


#### Description of setting







MR: Select a desired range on this screen.  
 RR: Select a desired range according to the remote range switch contact input.  
 AR: Automatically switched from Range 1 to Range 2 when the measured concentration exceeds 90% of Range 1. Automatically switched from Range 2 to Range 1 when the measured concentration becomes smaller than 80% of Range 1.  
 \* Operation set for each Ch only can be performed.




- (6) Then press the  key to confirm the selection.  
If “MR” is selected, the cursor moves to “Range Switch.”






↓ 


User Mode	Select an item with UP/DOWN and ENT Back with ESC
 Switch Ranges Calibration Parameters Alarm Setting Setting of Auto Calibration Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	

↓ 

Switch Range	Select Ch No. with UP / DOWN and ENT Back with ESC
 Ch1 NO <sub>x</sub> MR	 Range1 0-100 ppm Range2 0-2000 ppm
Ch2 SO <sub>2</sub> AR	 Range1 0-100 ppm Range2 0-2000 ppm
Ch3 CO <sub>2</sub> RR	 Range1 0-10 vol% Range2 0-20 vol%
Ch4 CO MR	 Range1 0-100 ppm Range2 0-2000 ppm
Ch5 O <sub>2</sub> MR	 Range1 0-10 vol% Range2 0-25 vol%

↓  (  ) 


Switch Range	Select method of Switch ranges with UP / DOWN and ENT Back with ESC
Ch1 NO <sub>x</sub> <b>MR</b>	 Range1 0-100 ppm Range2 0-2000 ppm
Ch2 SO <sub>2</sub> AR	 Range1 0-100 ppm Range2 0-2000 ppm
Ch3 CO <sub>2</sub> RR	 Range1 0-10 vol% Range2 0-20 vol%
Ch4 CO MR	 Range1 0-100 ppm Range2 0-2000 ppm
Ch5 O <sub>2</sub> MR	 Range1 0-10 vol% Range2 0-25 vol%

↓ 

<b>Range switch or previous screen</b>
--




## 6.1.2 Manual range switch

The range of the measured component can be switched manually as follows.

- (1) Select “MR” as range switch mode, and then press the  key.

Switch Range		Select method of Switch ranges with UP / DOWN and ENT Back with ESC
Ch1 NO <sub>x</sub>	MR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch2 SO <sub>2</sub>	AR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch3 CO <sub>2</sub>	RR	▶ Range1 0-10 vol% Range2 0-20 vol%
Ch4 CO	MR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch5 O <sub>2</sub>	MR	▶ Range1 0-10 vol% Range2 0-25 vol%




- (2) Move the highlight of the cursor to range selection, and then select a desired range by pressing the  or the  key. (The  mark indicates the currently selected range.)

Switch Range		Select range with UP/DOWN and ENT Back with ESC
Ch1 NO <sub>x</sub>	MR	▣ Range1 0-100 ppm Range2 0-2000 ppm
Ch2 SO <sub>2</sub>	AR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch3 CO <sub>2</sub>	RR	▶ Range1 0-10 vol% Range2 0-20 vol%
Ch4 CO	MR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch5 O <sub>2</sub>	MR	▶ Range1 0-10 vol% Range2 0-25 vol%




End of Range Switch

- (3) Then press the  key, and the measurement is carried out in the selected range.

**Note) If “RR” or “AR” is selected as range switch mode, this operation cannot be performed.**

**The range for O<sub>2</sub> conversion value, O<sub>2</sub> conversion average value, and O<sub>2</sub> average value is automatically switched if corresponding instantaneous value range is switched.**

### To close the setting

Press the  key to end the setting of range switch mode or range switch operation or stop the operation in the middle, and the setting operation is made invalid and the previous screen appears.

### Range identification contact operation

The range identification contact output corresponding to each Ch (component) is conductive when Range 1 is selected, and open when Range 2 is selected, which is applicable to any of the range switch mode selected.





Note that even if the range is switched during the hold of measurement value by remote hold contact input or the hold of measurement value at the time of calibration, the range identification contact output maintains the contact state immediately before the hold. After stop of the hold, the contact state of the current range is resumed.



# 6.2 Calibration setting


This mode is used to set calibration concentration and actions. The calibration setting involves calibration concentration, zero calibration, calibration range and auto calibration component/range.




## 6.2.1 Setting of calibration concentration





It allows you to set concentrations of the standard gas (zero and span) of each channel used for calibration.


- (1) During measurement, press the  key to display the User mode.
- (2) Point the cursor to “Calibration Parameters” by pressing the  or  key. Press the  key.




 





User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges  Calibration Parameters Alarm Setting Setting of Auto Calibration Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	


- (3) In the “Calibration Parameters” screen that appears, point the cursor to “Calibration Value” by pressing the  or  key. Press the  key.





  (  ) 




Cal. Parameters	Select an item with UP/DOWN and ENT Back with ESC
 Calibration Valve About ZERO Calibration About Calibration Range Auto Calibration Components / Range	

- (4) In the “Calibration Concentration Ch Selection” screen that appears, point the cursor to Ch you want to set by using the  or  key. Press the  key.



(

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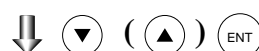
Cal. Settings		Select Ch No.	
Cal. Value		for setting calibration value	
CH	RANGE	ZERO	SPAN
 Ch1 NO <sub>x</sub>	0-100ppm	+0000.0	0100.0
	0-2000ppm	+00000	02000
Ch2 SO <sub>2</sub>	0-100ppm	+0000.0	0100.0
	0-2000ppm	+00000	02000
Ch3 CO <sub>2</sub>	0-10vol%	+000.00	010.00
	0-20vol%	+000.00	020.00
Ch4 CO	0-100ppm	+0000.0	0100.0
	0-2000ppm	+00000	02000
Ch5 O <sub>2</sub>	0-10vol%	21.00	01.00
	0-25vol%	21.00	01.00

  (  ) 

- (5) In the “Calibration Concentration Selection” screen that appears, select any concentration item you want to set by pressing the ,  or  key.

Then press the  key, and the selected value is highlighted.

Cal. Settings Cal. Value		Select setting value	
CH	RANGE	ZERO	SPAN
Ch1	0-100ppm	+0000.0	0100.0
NO <sub>x</sub>	0-2000ppm	+00000	02000
Ch2	0-100ppm	+0000.0	0100.0
SO <sub>2</sub>	0-2000ppm	+00000	02000
Ch3	0-10vol%	+000.00	010.00
CO <sub>2</sub>	0-20vol%	+000.00	020.00
Ch4	0-100ppm	+0000.0	0100.0
CO	0-2000ppm	+00000	02000
Ch5	0-10vol%	21.00	01.00
O <sub>2</sub>	0-25vol%	21.00	01.00







Cursor for setting value

Cal. Settings Cal. Value		Set calibration value	
CH	RANGE	ZERO	SPAN
Ch1	0-100ppm	+0000.0	0100.0
NO <sub>x</sub>	0-2000ppm	+00000	02000
Ch2	0-100ppm	+0000.0	0100.0
SO <sub>2</sub>	0-2000ppm	+00000	02000
Ch3	0-10vol%	+000.00	010.00
CO <sub>2</sub>	0-20vol%	+000.00	020.00
Ch4	0-100ppm	+0000.0	0100.0
CO	0-2000ppm	+00000	02000
Ch5	0-10vol%	21.00	01.00
O <sub>2</sub>	0-25vol%	21.00	01.00




End of Calibration  
Concentration Setting

- (6) In the “Calibration Concentration Value Setting” screen that appears, enter calibration gas concentration values (zero and span). For value entry, press the  or  key, and a 1-digit value increases or decreases. By pressing the , the digit moves.

After setting, save the entry by pressing the  key. The saved value becomes valid from the next calibration process.

**Note) Enter settings that correspond to each range. If zirconia type is used as O<sub>2</sub> sensor, select 21.00 for the field of Zero (when air is used), and select the concentration listed on the cylinder if the air contained in a cylinder is used.**

To close the setting

To close the calibration concentration value setting process or cancel this mode midway, press the  key.

A previous screen will return.

Setting range of values

NO<sub>x</sub>, SO<sub>2</sub>, CO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub>O external O<sub>2</sub> measurement and built-in paramagnetic O<sub>2</sub> sensor

External Zirconia O<sub>2</sub> measurement

**The setting cannot be performed beyond the range.**

Span gas: 1 to 105% of full scale  
(Full scale (FS) is the same as each range value.)

Zero gas: 5 to 25 vol%  
Span gas: 0.01 to 5 vol%

### 6.2.2 Setting of manual zero calibration

When zero calibration is made manually, set either all measurement components should be calibrated simultaneously or each component should be calibrated while selecting one by one.

↓

MODE

(1) During measurement, press the 

MODE

 key to display the User mode.

(2) Point the cursor to “Calibration Parameters” by pressing the 

▲

 or 

▼

 key. Press the 

ENT

 key.

User Mode

Select an item with UP/DOWN and ENT  
Back with ESC

Switch Ranges

▣

 Calibration Parameters

Alarm Setting

Setting of Auto Calibration

Setting of Auto Zero Calibration

Setting of Peak Alarm

Parameter Setting

↓

▼

(▲)

ENT

Cal. Parameters

Select an item with UP/DOWN and ENT  
Back with ESC

Calibration Valve

▣

 About ZERO Calibration

About Calibration Range

Auto Calibration Components / Range

↓

▼

(▲)

ENT

Cal. Settings  
ZERO Cal.

Select Ch No.

▣

 Ch1  
NO<sub>x</sub>

Range1 0-100 ppm

Range2 0-2000 ppm

at once

Ch2  
SO<sub>2</sub>

Range1 0-100 ppm

Range2 0-2000 ppm

at once

Ch3  
CO<sub>2</sub>

Range1 0-10 vol%

Range2 0-20 vol%

at once

Ch4  
CO

Range1 0-100 ppm

Range2 0-2000 ppm

at once

Ch5  
O<sub>2</sub>

Range1 0-10 vol%

Range2 0-25 vol%

each

↓




▼

(▲)

ENT


INZ-TN4ZKJ-E

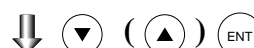
6 - 5

- (5) In the “Manual ZERO Calibration Selection” screen that appears, select “at once” or “each” by pressing the  or  key. When selecting “at once”, the Ch (components) to be set can be zero-calibrated at the same time. When selecting “each”, either of the Ch (components) to be selected is zero-calibrated. After setting, press the  key.

Cal. Settings ZERO Cal.		Set each or both Ch at ZERO Calibration	
Ch1 NO <sub>x</sub>	Range1 0-100 ppm Range2 0-2000 ppm		<b>at once</b>
Ch2 SO <sub>2</sub>	Range1 0-100 ppm Range2 0-2000 ppm		at once
Ch3 CO <sub>2</sub>	Range1 0-10 vol% Range2 0-20 vol%		at once
Ch4 CO	Range1 0-100 ppm Range2 0-2000 ppm		at once
Ch5 O <sub>2</sub>	Range1 0-10 vol% Range2 0-25 vol%		each

#### To close the setting

To close the manual zero calibration setting or to cancel this mode midway, press the  key. A previous screen will return.



**End of  
Manual Zero Calibration Setting**

#### Example

Whether “each” or “at once” can be determined for each Ch (component).

##### •Setting “each”

Select the Ch (component) on the manual zero calibration screen and then perform zero calibration.


##### •Setting “at once”

At a manual zero calibration, zero of Ch (components) for which “at once” was selected can simultaneously be calibrated.

**\* When the cylinder air or atmospheric air is used for the zero gas, select “At once.”**






#### Manual Calibration screen

##### • When setting all components to “each”:

ZERO Cal.		ENT : Go on Calibration of selected Ch ESC : Not calibration	
Ch1 NO <sub>x</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		-2.1
Ch2 SO <sub>2</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		-0.5
Ch3 CO <sub>2</sub>	▶Range1 0-10 vol% Range2 0-20 vol%		0.00
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm		0.0
Ch5 O <sub>2</sub>	▶Range1 0-10 vol% Range2 0-25 vol%		21.00

A single cursor will appear.

##### • When setting all components to “at once”:





ZERO Cal.		ENT : Go on Calibration of selected Ch ESC : Not calibration	
Ch1 NO <sub>x</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		0.0
Ch2 SO <sub>2</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		0.3
Ch3 CO <sub>2</sub>	▶Range1 0-10 vol% Range2 0-20 vol%		0.00
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm		-0.1
Ch5 O <sub>2</sub>	▶Range1 0-10 vol% Range2 0-25 vol%		21.00

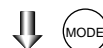
Cursors will appear at all components where “at once” is set.






### 6.2.3 Setting of calibration range

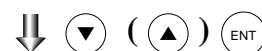
This mode is used to set if the range of each Ch (component) at the zero or span calibration (manual calibration or auto calibration) should be calibrated with a single range or 2 ranges.

- (1) During measurement, press the  key to display the User mode.
- (2) Point the cursor to “Calibration Parameters” by pressing the  or  key. Press the  key.






User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges <input checked="" type="checkbox"/> Calibration Parameters Alarm Setting Setting of Auto Calibration Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	

- (3) In the “Calibration Parameters” screen that appears, point the cursor to “About Calibration Range” by pressing the  or  key. Press the  key.





Cal. Parameters	Select an item with UP/DOWN and ENT Back with ESC
Calibration Valve About ZERO Calibration <input checked="" type="checkbox"/> About Calibration Range Auto Calibration Components / Range	

- (4) In the “Calibration Range Ch Selection” screen that appears, point the cursor to the Ch you want to set by pressing the  or  key. Press the  key.




Cal. Settings		Select Ch No.	
Cal. Range			
<input checked="" type="checkbox"/> Ch1 NO <sub>x</sub>	Range1 0-100 ppm Range2 0-2000 ppm	both	
Ch2 SO <sub>2</sub>	Range1 0-100 ppm Range2 0-2000 ppm	current	
Ch3 CO <sub>2</sub>	Range1 0-10 vol% Range2 0-20 vol%	current	
Ch4 CO	Range1 0-100 ppm Range2 0-2000 ppm	both	
Ch5 O <sub>2</sub>	Range1 0-10 vol% Range2 0-25 vol%	current	

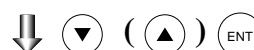


(5) On the “calibration range selection” screen that appears, select “both” or “current” by pressing the  or the .

- If “both” is selected, zero or span calibration is performed with Range 1 and Range 2 of the selected Ch interlocked.
- If “current” is selected, zero or span calibration is performed only for the range displayed when calibration of selected Ch is performed.

Press the  key after the selection, and the specified calibration is performed.


Cal. Settings		Set calibration range	
Cal. Range		current or both range	
Ch1 NO <sub>x</sub>	Range1 0-100 ppm Range2 0-2000 ppm	<b>both</b>	
Ch2 SO <sub>2</sub>	Range1 0-100 ppm Range2 0-2000 ppm	current	
Ch3 CO <sub>2</sub>	Range1 0-10 vol% Range2 0-20 vol%	current	
Ch4 CO	Range1 0-100 ppm Range2 0-2000 ppm	both	
Ch5 O <sub>2</sub>	Range1 0-10 vol% Range2 0-25 vol%	current	



**End of Manual Calibration Setting**

To close “Setting of Calibration Range”

To close “Setting of Calibration Range” or to cancel this mode midway, press the

 key. A previous screen will return.

### Example

Ch1 NO <sub>x</sub>	Range 1: 0 to 100 ppm Range 2: 0 to 2000 ppm	both
Ch2 SO <sub>2</sub>	Range 1: 0 to 100 ppm Range 2: 0 to 2000 ppm	current

Ch1: Range 1 and Range 2 are calibrated together with zero and span calibration.






Ch2: Only currently displayed range is calibrated with zero and span calibration.

### Note

**To perform calibration for “both,” set the same calibration gas concentration for both ranges.**

### Manual Calibration screen

When setting NO<sub>x</sub> and CO to “both”

ZERO Cal.		ENT : Go on calibration of selected Ch ESC : Not calibration	
Ch1 NO <sub>x</sub>	▶ Range1 0-100 ppm Range2 0-2000 ppm		-0.6
Ch2 SO <sub>2</sub>	▶ Range1 0-100 ppm Range2 0-2000 ppm		0.4
Ch3 CO <sub>2</sub>	▶ Range1 0-10 vol% Range2 0-20 vol%		0.00
Ch4 CO	▶ Range1 0-100 ppm Range2 0-2000 ppm		-0.1
Ch5 O <sub>2</sub>	▶ Range1 0-10 vol% Range2 0-25 vol%		21.00

Two cursors will appear in both ranges (Ch1 and Ch4).

## 6.2.4 Setting of auto calibration component/range

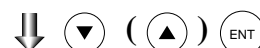
Select the Ch (component) and the range with which auto calibration is to be performed.

The Ch for which “AR” has been selected as range switch mode is calibrated in the range set here even when auto calibration is performed.



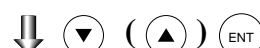
- (1) During measurement, press the key to display the User mode.
- (2) Point the cursor to “Calibration Parameters” by pressing the or key. Press the key.

User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges <input checked="" type="checkbox"/> Calibration Parameters Alarm Setting Setting of Auto Calibration Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	



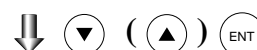
- (3) In the “Calibration Parameters” screen that appears, point the cursor to “Auto Calibration Components / Range” by pressing the or key. Press the key.

Cal. Parameters	Select an item with UP/DOWN and ENT Back with ESC
Calibration Valve About ZERO Calibration About Calibration Range <input checked="" type="checkbox"/> Auto Calibration Components / Range	



- (4) In the “Auto Calibration Components / Range” selection screen that appears, point the cursor to the Ch you want to set by pressing the or key. Press the key.

Cal. Settings Auto Cal.	Select Ch No.		
<input checked="" type="checkbox"/> Ch1 NO <sub>x</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm	enable	
Ch2 SO <sub>2</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm	enable	
Ch3 CO <sub>2</sub>	▶Range1 0-10 vol% Range2 0-20 vol%	enable	
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm	enable	
Ch5 O <sub>2</sub>	▶Range1 0-10 vol% ▶Range2 0-25 vol%	enable	



- (5) The cursor next to the range of the selected Ch (component) is highlighted. Select the range to be calibrated mainly by pressing the  $\blacktriangle$  or the  $\blacktriangledown$  key.
- (6) Then press the  $\text{ENT}$  key, and calibration is performed in the selected range.

#### To close "Auto Calibration Component/range" setting

Auto calibration and the manual calibration of the component with which "AR" has been selected as range switch mode are performed in the range selected here. In this case, once the calibration is started, the range is automatically switched, and on completion of the calibration, the original range is resumed.

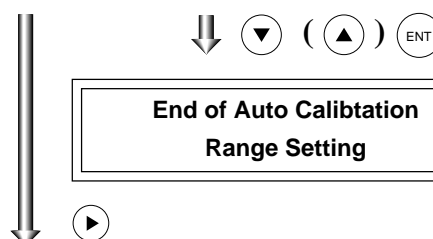
The range identification contact is interlocked with the range after the switch. However, if the hold setting is set to "ON," the contact status before calibration is maintained.

- (7) Press the  $\blacktriangleright$  key in the state described in (5), and the highlight is switched between "enable" and "disable" auto calibration.
- (8) Select "enable" of "disable" by pressing the  $\blacktriangle$  or the  $\blacktriangledown$  key.
- (9) Then press the  $\text{ENT}$  key.

#### To close the setting

Press the  $\text{ESC}$  key to exit automatic calibration component/range setting, and the previous screen appears.

Cal. Settings Auto Cal.		Select a range for auto calibration	
Ch1 NO <sub>x</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		enable
Ch2 SO <sub>2</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		enable
Ch3 CO <sub>2</sub>	▶Range1 0-10 vol% Range2 0-20 vol%		enable
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm		enable
Ch5 O <sub>2</sub>	▶Range1 0-10 vol% ▶Range2 0-25 vol%		enable



Cal. Settings Auto Cal.		Set enable or disable for auto calibration	
▶ Ch1 NO <sub>x</sub>	Range1 0-100 ppm Range2 0-2000 ppm		enable
Ch2 SO <sub>2</sub>	Range1 0-100 ppm Range2 0-2000 ppm		enable
Ch3 CO <sub>2</sub>	Range1 0-10 vol% Range2 0-20 vol%		enable
Ch4 CO	Range1 0-100 ppm Range2 0-2000 ppm		enable
Ch5 O <sub>2</sub>	Range1 0-10 vol% Range2 0-25 vol%		enable



**End of Auto Calibration  
component setting**

#### Operation by setting

Auto calibration is performed under the following rules.

1. Zero calibration is performed at the same time, for the Ch (component) with which "enable" is selected at the time of auto calibration and auto zero calibration.
2. Span calibration is performed in the order from smallest Ch No., for the Ch (component) with which "enable" is selected at the time of auto calibration.

#### Note





**ZERO calibration on auto calibration and auto zero calibration of the component with which "enable" is selected are performed in batch irrespective of the description in "6.2.2 Setting of manual zero calibration."**



## 6.3 Alarm setting


### 6.3.1 Setting of alarm values




The High/Low limit alarm output setting for the measured concentration and power off alarm (alarm 6 only) setting can be made during measurement. Arbitrary 6 alarm contact outputs can be used.





To change alarm setting, set the alarm ON/OFF setting to OFF, and then change the value.


- (1) During measurement, press the  key to display the User mode.
- (2) Point the cursor to “Alarm Setting” by pressing the  or  key. Press the  key.




 

User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges Calibration Parameters  Alarm Setting Setting of Auto Calibration Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	

- (3) After the alarm No. selection screen has appeared, point the cursor to the Alarm No. you want to set by pressing  or  key .
- Press the  key.





  (  ) 


Alarm Setting	Select Alarm No. or Hysteresis setting
 Alarm-1 Alarm-2 Alarm-3 Alarm-4 Alarm-5 Alarm-6	
Hysteresis	00 %FS

- (4) After the alarm item selection screen has appeared, operate the  or  key until the cursor is aligned with a desired item and press the  key.


**Note**

**Set the values so that H-limit value > L-limit value and that (H-limit value – L-limit value) > hysteresis.**


  (  ) 

Alarm Setting Alarm-1	Select an item with UP/DOWN and ENT Back with ESC
 Channel Ch 1 H-Limit Range 1 100.0 ppm Range 2 2000 ppm L-Limit Range 1 000.0 ppm Range 2 0000 ppm Kind of Alarm High ON / OFF OFF	

  (  ) 

(5) After setting, the alarm setting is now completed by pressing the  key.

#### To close the "Alarm Setting"

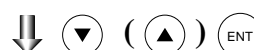
To close the "Alarm Setting" or to cancel this mode midway, press the  key.  
A previous screen will return.

#### Setting range

0% to 100% FS (Settable in each range).

Cursor for setting value

Alarm Setting Alarm-1	Select an item with UP/DOWN and ENT Back with ESC
Channel	Ch 1
H-Limit Range 1	100.0 ppm
Range 2	2000 ppm
L-Limit Range 1	000.0 ppm
Range 2	0000 ppm
Kind of Alarm	High
ON / OFF	OFF



End of Alarm Setting

#### Description of setting items

The alarm contact assigned the same number as the alarm is operated accordingly.

**Channel:** Channel setting targeted for issuance of alarm (Power off alarm can be selected for alarm 6.) One Ch No. can be selected for multiple alarms.

**H-Limit value:** Sets the high limit value (concentration) of alarm.

**L-Limit value:** Sets the low limit value (concentration) of alarm.

**Kind of Alarm:** Selects one of High limit alarm, Low limit alarm, and High limit or Low limit alarm, HH limit alarm, and LL limit alarm.

High, HH ... Alarm contact closes when above H-limit alarm.

Low, LL ... Alarm contact closes when below L-limit alarm.

High or Low ... Alarm contact closes when above H-limit value or below lower limit value.

If "Power" is selected for Channel, the contact is closed at all times while the power is on irrespective of the setting made here. (Alarm-6 only)

**ON/OFF:** Enables the alarm function if set at ON, or disables the alarm function if set at OFF.

\* The H-limit value cannot be set below the L-limit value, and the L-limit value cannot be set above the H-limit value.

If it is desired to set the H-limit value below the L-limit value already stored in the memory, reduce the L-limit value beforehand, and vice versa.

#### Typical on-screen display when an alarm occurs

When an H-limit alarm occurs, the "H-alarm" message comes on in the field of relevant Ch (component).  
("L-alarm" for L-limit alarm, "HH-alarm" for HH limit alarm, and "LL-alarm" for LL limit alarm)

Ch 1	H-alarm	
Ch 2	SO <sub>2</sub> (0-100)	0.0 ppm
Ch 3	CO <sub>2</sub> (0-10)	0.003 vol%
Ch 4	CO (0-100)	0.0 ppm
Ch 5	O <sub>2</sub> (0-25)	21.00 vol%

#### Note

For 10 minutes after turning on power, the alarm judgment is inactive.

### 6.3.2 Hysteresis setting

To prevent chattering of an alarm output near the alarm setting values, set the value of hysteresis.

- (1) In the “Alarm No. Selection” screen that appears, point the cursor to “Hysteresis” by pressing the  $\blacktriangle$  or  $\blacktriangledown$  key. Press the  $\text{ENT}$  key.

- (2) In the “Hysteresis Value Setting” screen that appears, enter hysteresis values. For the value entry, 1-digit value is increased or decreased by pressing the  $\blacktriangle$  or  $\blacktriangledown$  key, and pressing the  $\blacktriangleright$  key moves the digit. After setting, press the  $\text{ENT}$  key.

#### To close "Hysteresis Setting"

To close the “Hysteresis Setting” or cancel the mode midway, press the  $\text{ESC}$  key. A previous screen will return.

#### Setting range

0 to 20% of full scale  
[% full scale (FS)] represents the percentage with the width of the range of each component regarded as 100%.

Alarm Setting	Select Alarm No. or Hysteresis setting
Alarm-1 Alarm-2 Alarm-3 Alarm-4 Alarm-5 Alarm-6	
$\blacktriangledown$ Hysteresis	00 %FS

$\blacktriangledown$   $\blacktriangledown$  (  $\blacktriangle$  )  $\text{ENT}$

Alarm Setting	Set Hysteresis 0 to 20%FS available
Alarm-1 Alarm-2 Alarm-3 Alarm-4 Alarm-5 Alarm-6	
Hysteresis	00 %FS

$\blacktriangledown$   $\blacktriangledown$  (  $\blacktriangle$  )  $\text{ENT}$

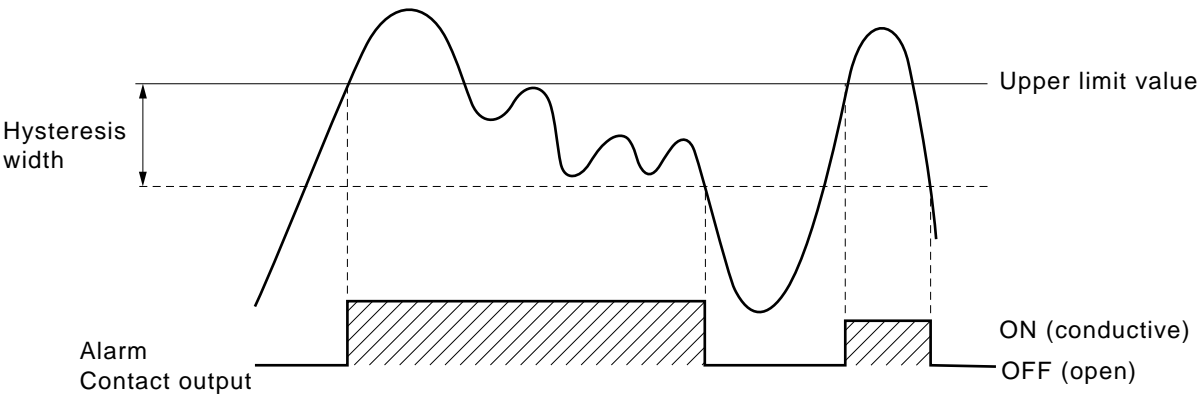
End of Hysteresis Setting

#### Note

The hysteresis is common to all alarms (components).

### Hysteresis (In case of upper limit alarm)

An alarm output is turned ON if measurement value exceeds the upper limit value as shown below. Once the alarm output has been turned ON, it is not turned OFF as long as the indication does not fall below the hysteresis width from the upper limit value.










## 6.4 Setting of auto calibration

### 6.4.1 Auto calibration







Auto calibration is automatically carried out at the time when zero calibration and span calibration are set.




Before changing the setting of auto calibration, set the ON/OFF to OFF.

- (1) During measurement, press the  key to display the User mode.
- (2) Point the cursor to "Setting of Auto Calibration" by pressing the  or  key. Press the  key.


↓ 

User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges Calibration Parameters Alarm Setting <input checked="" type="checkbox"/> Setting of Auto Calibration Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	

- (3) In the "Setting of Auto Calibration" screen that appears, point the cursor to any item you want to set by pressing the  or  key. Press the  key.
- (4) In the "Auto Calibration Parameter Setting" screen that appears, perform the value entry or the setting. For the value entry or setting change, use the  or  key. To change the setting, use the  key to move the cursor to the right.

↓  (  ) 


Set Auto Cal.	Select setting item
<input checked="" type="checkbox"/> Start Time      SUN 12:00 Cycle              07 day Flow Time ON / OFF          OFF  Time : MON 12:34	
Auto Calibration Run	




After setting, press the  key, and auto calibration is carried out by the entered setting value.

#### Description of setting items





- Start Time : Setting at the first calibration (day of the week, hour, minute)
- Cycle : A period between the start time of one calibration and another (unit : hour/day)
- Flow Time : The time required for replacement by calibration gas  
Time required for replacement of sample gas after the calibration is completed (Set by calibration gas. See the next page.)
- ON/OFF : ON/OFF of auto calibration

#### To close "Setting of Auto calibration"

To close the "Setting of Auto calibration" or cancel this mode midway, press the  key.  
A previous screen will return.


↓  (  ) 


Set Auto Cal.	Set Start Time
Start Time <b>SUN</b> 12:00 Cycle              07 day Flow Time ON / OFF          OFF  Time : MON 12:34	
Auto Calibration Run	

↓    




<b>End of Auto Calibration Setting</b>
--


<Gas flow time> setting

- (1) Press the  key in a state where the cursor is placed next to "Flow Time," and the flow time setting screen shown at right appears.






Set Auto Cal.	Select setting item
Start Time	SUN 12:00
Cycle	07 day
 Flow Time	ON / OFF
	OFF
Time : MON 12:34	
Auto Calibration Run	




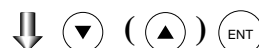
- (2) On the flow time setting screen that appears, move the cursor to the gas you want to change the setting by pressing the  or the  key, and then press the  key.

Set Auto Cal.	Select a Flow time
 Zero	350 sec.
Ch1 Span	350 sec.
Ch2 Span	350 sec.
Ch3 Span	350 sec.
Ch4 Span	300 sec.
Ch5 Span	300 sec.
Ex. time	300 sec.



- (3) The highlighted value can be changed. Change the value by pressing the  or the  key, and then move the cursor to the right by pressing the  key.
- (4) After changing the value, press the  key.
- (5) Press the  key to return to the automatic calibration setting screen.

Set Auto Cal.	Set flow time of calibration gas 60 to 900 sec
Zero	 350 sec.
Ch1 Span	350 sec.
Ch2 Span	350 sec.
Ch3 Span	350 sec.
Ch4 Span	300 sec.
Ch5 Span	300 sec.
Ex. time	300 sec.



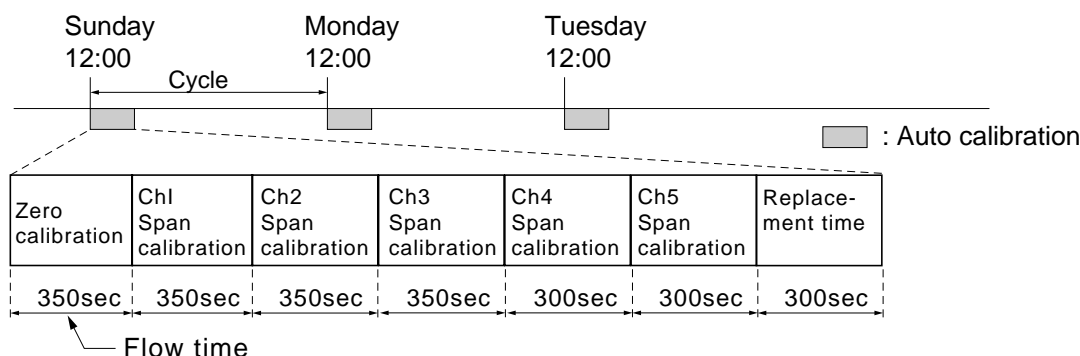
**Note) Only the Chs used are displayed on this screen. The Ex. time is the output signal hold extension time after the completion of calibration. It is valid only when the hold setting is set to "ON." The Ex. time set here is also the hold extension time at the time of manual calibration.**

Auto calibration status contact output is closed during auto calibration (including Ex. time), and is open in other cases.

#### Example

Start Time	SUN	12:00
Cycle	1	day
Flow Time	Zero	350 sec
	Ch1 Span	350 sec
	Ch1 Span	350 sec
	Ch1 Span	350 sec
	Ch1 Span	300 sec
	Ch1 Span	300 sec
	EX. time	300 sec
ON/OFF	ON	

In case where auto calibration is carried out at the above setting.



(An example of “Ch1: through Ch5: enable”, as given in Item 6.2.4 “Auto Calibration Components/range”)

#### Setting range

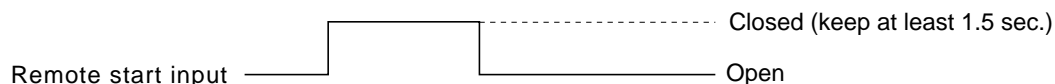
Cycle	: 1 to 99 hours or 1 to 40 days (initial value 7days)
Flow time	: 60 to 900 sec (initial value 300sec)

#### Caution

- When an auto calibration starts, the measurement screen automatically appears.
- Any operation other than “Stop Auto Calibration” (see Item 6.4.2) is not permitted during auto calibration. “Stop Auto Calibration” cannot be performed with the key lock to ON. To cancel auto calibration forcibly, set the key lock to OFF and then execute “Stop Auto Calibration”.
- Turn on the power again after it is turned off (including the case of power failure) at the time set as the next start time in auto calibration, and then repeat it in the set cycle.

#### Remote start




Whether the auto calibration is set at ON or OFF, an auto calibration is available by keeping the remote start input closed for at least 1.5 seconds.




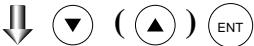
### 6.4.2 Forced run/stop of auto calibration




Auto calibration can be performed just once or forcibly stopped while the calibration is performed.


#### 6.4.2.1 Execution of auto calibration (only once)

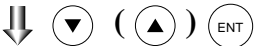
- (1) Display the User mode screen. Move the cursor to “Setting of Auto Calibration” by pressing the  or the  key, and then press the  key.



User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges Calibration Parameters Alarm Setting  Setting of Auto Calibration Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	



- (2) In the “Setting of Auto Calibration” item selection screen that appears, point the cursor to “Auto Calibration Run” by pressing the  or  key. Press the  key.

Set Auto Cal.	Select setting item
Start Time      SUN 12:00 Cycle            07    day Flow Time ON / OFF        OFF  Time : MON 12:34	
 Auto Calibration Run	







- (3) “Run” is highlighted, displaying a message to confirm the execution of auto calibration. Press the  key to execute the auto calibration, and press the  key to cancel.

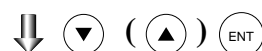
Set Auto Cal.	Auto Cal. Run ENT : Run / Stop ESC : Cancel
Start Time      SUN 12:00 Cycle            07    day Flow Time ON / OFF        OFF  Time : MON 12:34	
Auto Calibration <b>Run</b>	




### 6.4.2.2 Forced stop of auto calibration

This mode is used to stop the auto calibration forcibly.


- (1) In the User mode that is displayed, point the cursor to “Setting of Auto Calibration” by pressing the  or  key. Press the  key.

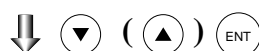
User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges Calibration Parameters Alarm Setting  Setting of Auto Calibration Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	





- (2) In the “Setting of Auto Calibration” item selection screen that appears, point the cursor to “Auto Calibration Stop” by pressing the  or  key. Press the  key.

(“Auto Calibration Stop” appears when the screen is selected while auto calibration is performed.)

Set Auto Cal.	Select setting item
Start Time      SUN 12:00 Cycle            07    day Flow Time       300   sec ON / OFF        OFF  Time : MON 12:34	
 Auto Calibration Stop	



- (3) “Stop” is highlighted, displaying a message to confirm the stop of auto calibration. Press the  key to stop the auto calibration, and press the  key to cancel (not stopped).

Set Auto Cal.	Auto Cal. Stop ENT : Run / Stop ESC : Cancel
Start Time      SUN 12:00 Cycle            07    day Flow Time       300   sec ON / OFF        OFF  Time : MON 12:34	
Auto Calibration <b>Stop</b>	

## “Auto Calibration” screen

### Example

In case where setting the auto calibration components (see Item 6.2.4) to “Ch1: enable” and “Ch2: enable”

- Zero calibration

A message, “Zero cal.” blinks at Ch1 and Ch2.

C	1	ZERO cal.	0.5	ppm
C	2	ZERO cal.	0.3	ppm
Ch	3	CO <sub>2</sub> 0-10	0.000	vol%
Ch	4	CO 0-100	0.0	ppm
Ch	5	O <sub>2</sub> 0-25	21.02	vol%

- Ch1 span calibration

A message, “Span cal.” blinks at Ch1.

C	1	SPAN cal.	90.8	ppm
Ch	2	SO <sub>2</sub> 0-100	0.0	ppm
Ch	3	CO <sub>2</sub> 0-10	0.00	vol%
Ch	4	CO 0-100	0.0	ppm
Ch	5	O <sub>2</sub> 0-25	0.00	vol%

- Ch2 span calibration

A message, “Span cal.” blinks at Ch2.

Ch	1	NO <sub>x</sub> 0-100	0.0	ppm
C	2	SPAN cal.	95.0	ppm
Ch	3	CO <sub>2</sub> 0-10	0.00	vol%
Ch	4	CO 0-100	0.0	ppm
Ch	5	O <sub>2</sub> 0-25	0.00	vol%

## Caution

During auto calibration, any key operation is not permitted other than operations such as key lock ON/OFF and “Stop Auto Calibration.”

When the key lock is set at ON, even the “Auto Calibration Stop” cannot be used.











To stop “Auto Calibration” forcibly, set the key lock to OFF and then execute “Auto Calibration Stop.”


## 6.5 Setting of auto zero calibration

### 6.5.1 Auto zero calibration

Auto zero calibration is automatically carried out at the time when zero calibration is set. Components for which a calibration is to be made are determined by setting of auto calibration component in Item 6.2.4.

Before changing the setting of auto zero calibration, set the ON/OFF to OFF.


- (1) During measurement, press the  key to display the User mode.
- (2) Point the cursor to "Setting of Auto Zero Calibration" by pressing the  or  key. Press the  key.
- (3) In the "Setting of Auto Zero Calibration" screen that appears, point the cursor to any item you want to set by pressing the  or  key. Press the  key.
- (4) In the "Auto Zero Calibration Parameter Setting" screen that appears, perform the value entry or the setting. For the value entry or setting change, use the  or  key. To change the setting, use the  key to move the cursor to the right.


After setting, press the  key, and auto zero calibration is carried out by the entered setting value.

#### Description of setting items





- Start Time : Setting at the first calibration (day of the week, hour, minute)
- Cycle : A period between the start time of one calibration and another (unit : hour/day)
- Flow Time : The time required for the calibration gas to be replaced in the cell
- ON/OFF : ON/OFF of auto zero calibration

#### To close "setting of Auto Zero Calibration"





To close the "Setting of Auto Zero Calibration" or cancel this mode midway, press the  key. A previous screen will return.





User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges Calibration Parameters Alarm Setting Setting of Auto Calibration <input checked="" type="checkbox"/> Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	






  (  ) 

Set Auto Zero Cal.	Select setting item
<input checked="" type="checkbox"/> Start Time      SUN 12:00 Cycle              07 day Flow Time        300 sec. ON / OFF        OFF  Time : MON 12:34	
Auto Zero Calibration Run	

  (  ) 

Set Auto Zero Cal.	Set Start Time
<input checked="" type="checkbox"/> Start Time <b>SUN</b> 12:00 Cycle              07 day Flow Time        300 sec. ON / OFF        OFF  Time : MON 12:34	
Auto Zero Calibration Run	

Press the  or the  key, and date and time are displayed alternately.

End of Auto Zero Calibration Setting
--------------------------------------

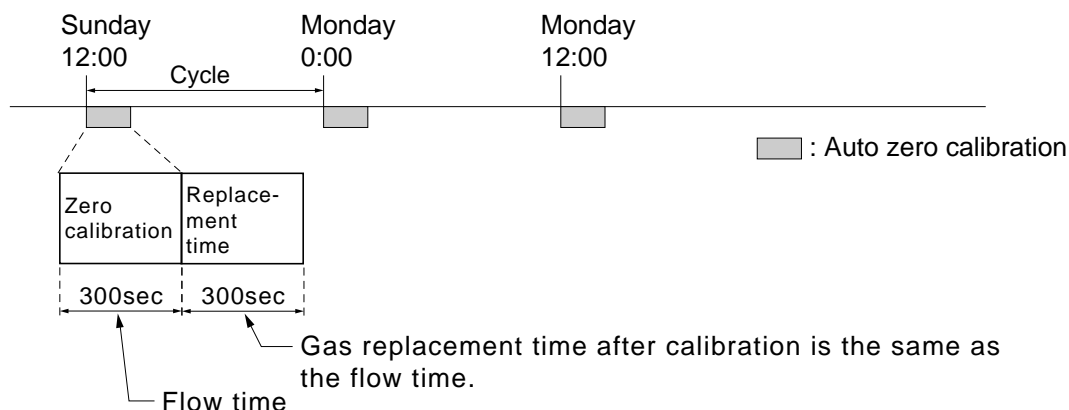


Auto calibration status contact output is closed during auto zero calibration, and is open in other cases.

#### Example

Start time	SUN	12:00
Cycle	12	hour
Flow time	300	sec
ON/OFF	ON	

In case where auto zero calibration is carried out at the above setting.



(An example of “Ch1: through Ch5: enable,” as given in Item 6.2.4 “Auto Calibration Components/range”)

#### Setting range

Cycle : 1 to 99 hours or 1 to 40 days (initial value 7days)  
Flow time : 60 to 900 sec (initial value 300sec)




#### Caution


- When an auto zero calibration starts, the measurement screen automatically appears.
- Any operation other than "Stop Auto Zero Calibration" (see Item 6.5.2) is not permitted during auto zero calibration. "Stop Auto Zero Calibration" cannot be performed with the key lock to ON. To cancel auto zero calibration forcedly, set the key lock to OFF and then execute "Stop Auto Zero Calibration."
- If the auto calibration period and auto zero calibration period have overlapped, the auto calibration is retained, ignoring the auto zero calibration of that period.
- When the hold setting is set to ON, the hold time of auto calibration contact and measurement value output signal is extended after calibration for gas replacement time.
- Turn on the power again after it is turned off (including the case of power failure) at the time set as the next start time in auto zero calibration, and then repeat it in the set cycle.

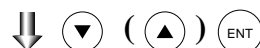
## 6.5.2 Forced run/stop of auto zero calibration




Auto zero calibration can be performed just once, or auto zero calibration can be forcibly stopped during calibration.


### 6.5.2.1 Execution of auto zero calibration (just once)

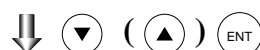
- (1) Move the cursor to “Setting of Auto Zero Calibration” by pressing the  or the  key on the user mode screen, and then press the  key.



User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges Calibration Parameters Alarm Setting Setting of Auto Calibration  Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	



- (2) In the “Setting of Auto Zero Calibration” item selection screen that appears, point the cursor to “Auto Zero Calibration Run” by pressing the  or  key. Press the  key.

Set Auto Zero Cal.	Select setting item
Start Time      SUN 12:00 Cycle            07 day Flow Time      300 sec. ON / OFF       OFF  Time : MON 12:34	
 Auto Zero Calibration Run	






- (3) “Run” is highlighted, displaying a message to confirm execution of auto zero calibration. Press the  key to execute the calibration, and press the  key to cancel.

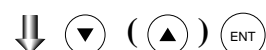
Set Auto Zero Cal.	Auto zero Run ENT : Run / Stop ESC : Cancel
Start Time      SUN 12:00 Cycle            07 day Flow Time      300 sec. ON / OFF       OFF  Time : MON 12:34	
Auto Zero Calibration <b>Run</b>	




### 6.5.2.2 Forced stop of auto zero calibration

This mode is used to cancel the auto zero calibration forcibly.

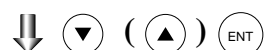
- (1) In the User mode that is displayed, point the cursor to “Setting of Auto Zero Calibration” by pressing the  or  key. Press the  key.



User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges Calibration Parameters Alarm Setting Setting of Auto Calibration <input checked="" type="checkbox"/> Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	



- (2) In the “Setting of Auto Zero Calibration” item selection screen that appears, point the cursor to “Auto Zero Calibration Stop” by pressing the  or  key. Press the  key.  
 (“Auto Zero Calibration Stop” appears when the screen is selected while auto zero calibration is performed.)

Set Auto Zero Cal.	Select setting item
Start Time    SUN 12:00 Cycle         07 day Flow Time    300 sec. ON/OFF       OFF  Time : THU 10:56	
<input checked="" type="checkbox"/> Auto Zero Calibration Stop	



- (3) “Stop” is inverted. A message appears, prompting you to verify that you want to stop auto zero calibration. Press the  key to stop the auto zero calibration and the  key to cancel (not stopped).

Set Auto Zero Cal.	Auto Zero Stop ENT : Run / Stop ESC : Cancel
Start Time    SUN 12:00 Cycle         07 day Flow Time    300 sec. ON/OFF       OFF  Time : THU 10:56	
Auto Zero Calibration <b>Stop</b>	

## “Auto Zero Calibration” screen

### Example

In case where setting the auto calibration components (see Item 6.2.4) to “Ch1: enable” and “Ch2: enable”

- Zero calibration

A message, “Zero cal.” blinks at Ch1 and Ch2.

1	Ch1	ZERO cal.	0.5	ppm
2	Ch2	ZERO cal.	0.3	ppm
3	Ch1	CO <sub>2</sub> (0-10)	0.00	vol%
4	Ch2	CO (0-100)	0.0	ppm
5	Ch1	O <sub>2</sub> (0-25)	21.02	vol%

### Caution

During auto zero calibration, any key operation is not permitted other than operations such as key lock ON/OFF and “Stop Auto Zero Calibration.”








When the key lock is set at ON, even the “Stop Auto Zero Calibration” cannot be used.

To stop “auto zero calibration” forcibly, set the key lock to OFF and then execute “Auto Zero Calibration Stop.”



# 6.6 Peak alarm setting


When the peak number of times CO concentration exceeds the upper limit value during measurement exceeds the set number, an alarm is provided.

The peak alarm and this setting screen appear only when an option is added.

- (1) Press the  key in the Measurement mode, and the User mode appears.
- (2) Point the cursor to “Setting of Peak Alarm” by pressing the  or  key. Press the  key.
- (3) In the “Peak Alarm Setting” item selection screen that appears, point the cursor to any item you want to set by pressing the  or  key. Press the  key.



- (4) Then, enter numeric values and perform the setting.


Entering the numeric values or setting the items should be carried out by using the  or  key.





After setting, press the  key, and the set values are saved.


Description of setting items





- Peak Alarm : ON/OFF of peak alarm
- Alarm Value : If measuring value exceeds the set alarm value, a peak counter counts 1 time.
- Alarm Count : When a peak in excess of the setting time occurs, a peak count alarm output is provided.
- Hysteresis : To prevent possible chattering when the measuring value may exceed the set peak concentration by only 1 time, the peak count has an allowance in the hysteresis width.








User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges Calibration Parameters Alarm Setting Setting of Auto Calibration Setting of Auto Zero Calibration  Setting of Peak Alarm Parameter Setting	



Peak Alarm	Select setting item
 Peak Alarm OFF Alarm Value 0500 ppm Alarm Count 05 times Hysteresis 00 %FS	



Peak Alarm	Set Peak Alarm ON or OFF
Peak Alarm  Alarm Value 0500 ppm Alarm Count 05 times Hysteresis 00 %FS	

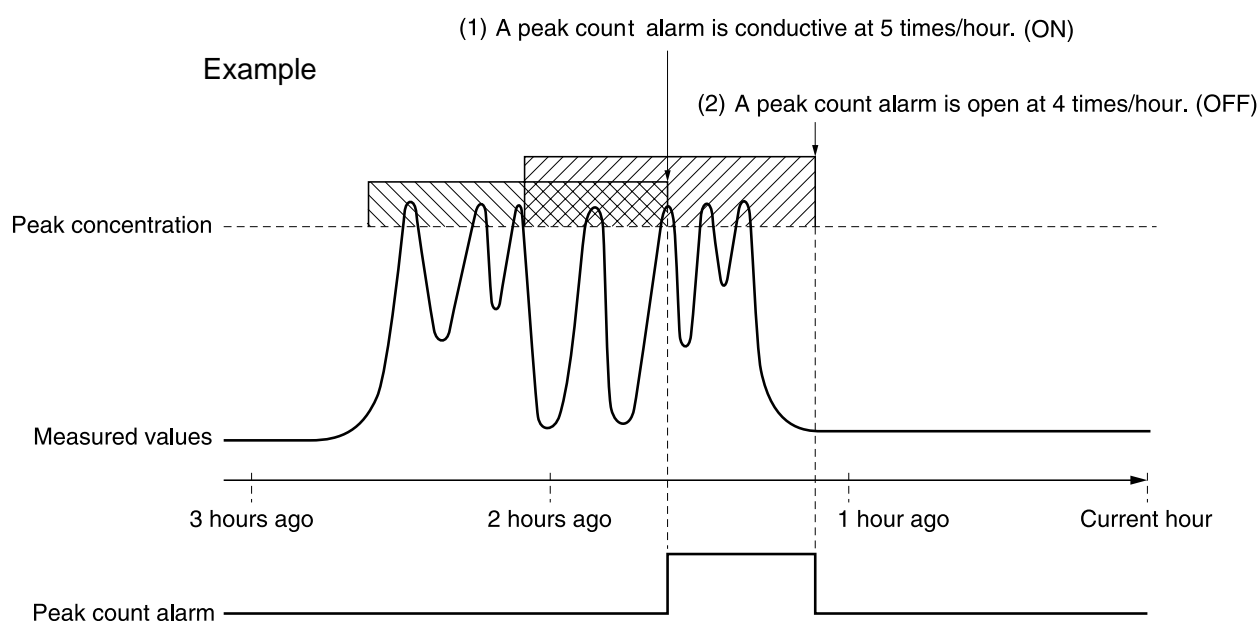




End of Peak Alarm Setting

### Setting range

- Alarm value : 10 to 1000 ppm → 5 ppm step (initial value: 500 ppm)
  - Alarm count : 1 to 99 times → (initial value: 5 times)
  - Hysteresis : 0 to 20 % of full scale → (initial value: 0% of full scale)
- [% full scale] represents the percentage with the CO range regarded as 100%.

### Action of peak alarm



If CO concentration exceeds the alarm value, counting will begin. If the number of peaks is over the set times per hour, a peak alarm contact output becomes closed (ON). If it is less than the set times per hour, it is open (OFF). Since 5 times of peaks /hour is marked at (1)  section from the above graph, the peak count alarm is turned ON. Since peaks of more than 5 times per 1 hour occur at the interval between (1) and (2) , the peak count alarm remains ON. Since at (2), peaks are reduced to 4 times per hour, it is turned OFF.

Like the hysteresis of the alarm setting, the hysteresis prevents possible chattering when measured gas is fluctuated near the alarm value.

\* For 10 minutes after the power is turned ON, a peak alarm counting is not carried out.

### Releasing peak count alarm

To release the peak count alarm, set the peak alarm to OFF.  
Turning on the peak alarm initiates counting from 0.





# 6.7 Parameter setting



It allows you to carry out the parameter setting such as time, key lock, etc., as required. Items to be set are as follows:


## Description of setting items




- Current Time : Current year, month, date, day of the week, hour, and minute setting  
(The display appears in this order.)  
Note: The clock backup time is 2 days. If power is turned on after it is kept off for 2 days or longer, make the time setting again.
- Key Lock : Sets with ON/OFF so that any key operation except the key lock OFF cannot be performed.
- Output Hold : Sets whether Calibration Output is held or not, and the holding value setting.
- Reset Av. Output : Resets the average value.
- Response time : Sets the response time of electrical system.
- Average Period : Sets the moving average time.
- Backlight Timer : Sets automatic OFF of the backlight of display unit and the time until backlight out.
- Maintenance mode : Enters passwords to switch to the Maintenance mode.





\* For the maintenace mode, see Item 6.8.


- (1) To display the User mode, press the  key in the measurement mode.
- (2) Point the cursor to “Parameter Setting” by pressing the  or  key. Press the  key.

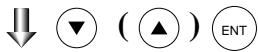
 

User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges Calibration Parameters Alarm Setting Setting of Auto Calibration Setting of Auto Zero Calibration Setting of Peak Alarm  Parameter Setting	

- (3) In the “Parameter Setting” screen that appears, point the cursor to any item you want to set by pressing the  or  key. Press the  key.

  (  ) 

Parameter	Select setting item
 Current Time	05/01/27 THU 13:50
Key Lock	OFF
Output Hold	OFF Current
Reset Av. Output	Reset
Response Time	
Average Period	
Backlight Timer	ON 5 min
To Maintenance Mode	0000



- (4) In the Parameter Setting screen that appears, enter the numeric values and set the items. Entering the numeric values or setting the items should be carried out by using the  $\blacktriangle$  or  $\blacktriangledown$  key. To move the cursor to the right, press the  $\blacktriangleright$  key. After setting, press the  $\text{ENT}$  key, that the parameter setting is carried out with the value you set.

#### To close Parameter Setting screen

To close the "Parameter Setting" screen or cancel this mode midway, press the  $\text{ESC}$  key.

A previous screen will return.

Parameter	Set day of week
Current Time	05/01/27 THU 13:50
Key Lock	OFF
Output Hold	OFF Current
Reset Av. Output	Reset
Response Time	
Average Period	
Backlight Timer	ON 5 min
To Maintenance Mode	0000



**End of Parameter Setting**

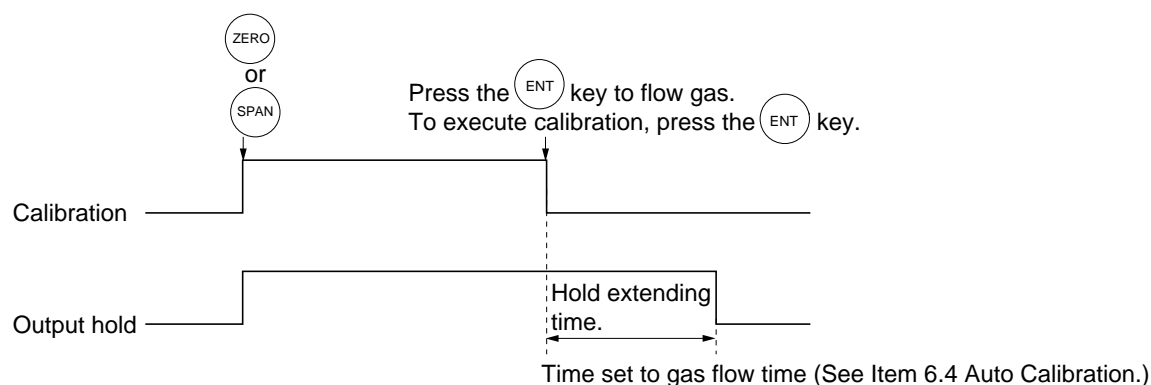
#### Setting Range

- Hold setting : 0 to 100% FS
- Response time : 1 to 60sec. (Initial value: 15 sec)
- Average period : 1 to 59 min or 1 to 4 hours (Initial value: 1 hour)  
When setting the unit of 1 to 59 minutes is terms of minute  
or 1 to 4 hours with hour
- Backlight Timer : 1 to 60 min (Initial value: OFF)
- Maintenance mode : 0000 to 9999 (Initial value: 0000)

## Output Hold

By setting an output hold to ON, an output signal of each channel are held during the calibration (manual calibration and auto calibration) and for the gas flow time (refer to Item 6.4, Setting of Auto Calibration). Regardless of Hold ON/OFF setting, an output signal can be held via an external input.

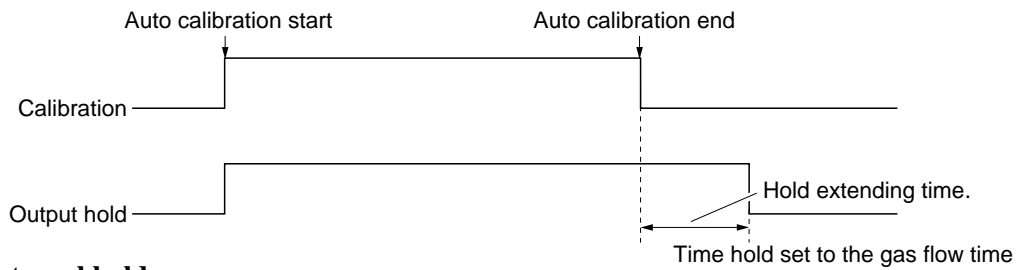
### (1) Manual calibration



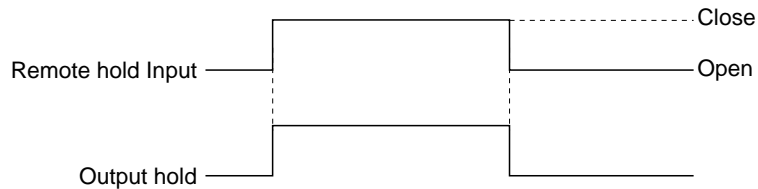


---

**(2) Auto calibration**



**(3) External hold**



**(4) Screen display during Holding**


The “on Hold” message blinks on the measuring screen.


Since the screen displays the process of calibration is displayed during the manual calibration, “on Hold” is not displayed even if the output signal is held, but the screen is displayed with the hold extending time.

- (5)** If calibration is cancelled after the calibration gas is supplied regardless of during manual calibration or auto calibration, the holding extending time will be performed.




- (6) You can select the value for hold from the value immediately before entering output hold, “current,” and arbitrary value, “setting.”

Follow the procedures shown below to make the setting.

- 1) Press the  key in a state where the cursor is placed next to Hold.




Parameter	Select setting item
Current Time	05/01/27 THU 13:50
Key Lock	OFF
 Output Hold	ON Current
Reset Av. Output	Reset
Response Time	
Average Period	
Display OFF	ON 5 min
To Maintenance Mode	0000




- 2) “ON” or “OFF” is highlighted. Press the  or the  key to select ON or OFF. Press the  key to return to (1).



Parameter	Select Hold ON or OFF
Current Time	05/01/27 THU 13:50
Key Lock	OFF
Output Hold	<b>ON</b> Current
Reset Av. Output	Reset
Response Time	
Average Period	
Display OFF	ON 5 min
To Maintenance Mode	0000







- 3) Press the  key in a state ON/OFF is highlighted, and “Current” or “Setting” is highlighted. Select “Current” or “Setting” by pressing the  or the  key.


Parameter	Select Hold setting
Current Time	05/01/27 THU 13:50
Key Lock	OFF
 Output Hold	ON <b>Setting</b>
Reset Av. Output	Reset
Response Time	
Average Period	
Display OFF	ON 5 min
To Maintenance Mode	0000








- 4) Press the  key while “Current” is selected to return to (1). Press the  key while “Setting” is selected to go to the setting entering screen.  
 “Current”: Holds the value immediately before the hold.  
 “Setting”: Holds the value arbitrarily set.


- 5) On the parameter hold screen that appears, move the cursor next to the Ch (component) you want to make the setting by pressing the  or the  key, and then press the  key.

↓ 

Parameter Hold	Select Ch No.			
 Ch1	NO <sub>x</sub>	010	%FS	
Ch2	SO <sub>2</sub>	020	%FS	
Ch3	CO <sub>2</sub>	015	%FS	
Ch4	CO	012	%FS	
Ch5	O <sub>2</sub>	022	%FS	

- 6) The value is highlighted, indicating that the value can be changed. Change the value by pressing the  or the  key, and then move the cursor to the right by pressing the  key.
- 7) After the value is changed, press the  key.


↓ 

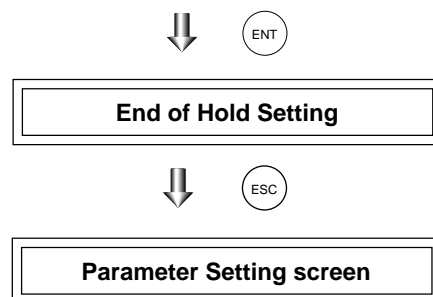
Parameter Hold	Set Hold value 0 to 100%FS			
Ch1	NO <sub>x</sub>	 010	%FS	
Ch2	SO <sub>2</sub>	020	%FS	
Ch3	CO <sub>2</sub>	015	%FS	
Ch4	CO	012	%FS	
Ch5	O <sub>2</sub>	022	%FS	

#### Meaning of setting

The setting is expressed in % against the range for both ranges.

When 0 to 1000 ppm is selected as the range, for example, if 10% FS is selected as hold setting, the output equivalent to 100 ppm is output and held irrespective of the measurement value at that time.

- 8) Press the  key to return to the parameter setting screen.



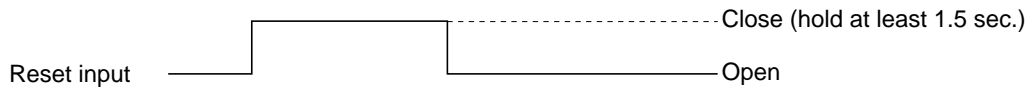
#### Description of setting

- Instantaneous value display of the measurement cannot be held. (Output only can be held.)
- If set value is selected for hold, instantaneous O<sub>2</sub> conversion value is calculated and held based on the set value.
- Range identification contact output cannot be switched even if the range is switched during the hold.

---

## Average value reset

This mode is used to clear all average values O<sub>2</sub> conversion average and O<sub>2</sub> average, and restarts averaging. All average values are reset at a time. The indication value and output value is 0 ppm, vol% or so at the time of the reset input (Refer to the average period).



So long as close, resetting lasts.

At the edge of changing from closing to opening, the average action restarts.

## Response time

The response time of the electrical system can be changed.

Setting is available by components.

**Note) It does not provide exact seconds for the setting time, but it gives a guide of the setting time.**

**The setting value can be modified as requested by the customer.**


Parameter		Select Ch No.	
Response Time			
▶ Ch1	NO <sub>x</sub>	10	sec.
Ch2	SO <sub>2</sub>	20	sec.
Ch3	CO <sub>2</sub>	15	sec.
Ch4	CO	12	sec.
Ch5	O <sub>2</sub>	22	sec.

## Average period

It allows you to set an average period of the average value of O<sub>2</sub> conversion and O<sub>2</sub> average.

It enables you to set an average time of 1 to 59 minutes (1-minute step) or 1 to 4 hours (1-hour step).

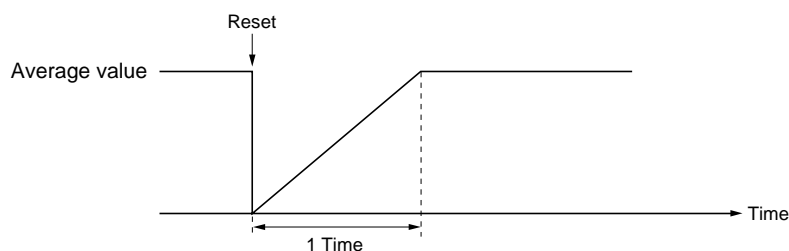
Changing the setting resets the average value of O<sub>2</sub> conversion and O<sub>2</sub> average value.

(Pressing the  validates the resetting only for components whose setting was changed.)

Parameter		Select Ch No.	
Average Period			
▶ Ch9	$\frac{\mu\text{g}}{\text{cu}} \text{NO}_x$	01	hour
Ch10	$\frac{\mu\text{g}}{\text{cu}} \text{SO}_2$	01	hour
Ch11	$\frac{\mu\text{g}}{\text{cu}} \text{CO}_2$	01	hour
Ch12	$\frac{\mu\text{g}}{\text{cu}} \text{O}_2$	01	hour

### Example of average action

In case the average period was set to 1 hour.



- Sampling occurs every 30 seconds.
- Every 30 seconds, the average for last 1 hour (time setting) is output.
- At the instant of resetting, zero is assumed for all past values. It means that the average value will not be correct for 1 hour after resetting.

### Backlight Timer

Automatic OFF setting of the backlight of the LCD unit can be made.

When the specified time elapses from when the measurement screen is resumed, the backlight is automatically turned off. Press any key to reset backlight OFF.

Only when ON is selected, the time until auto OFF is displayed. Press the **▶** key in this state, and the time setting can be changed by pressing the **▲** or the **▼** key. Press the **ENT** key to confirm the selection.

If OFF is selected, the backlight is not turned off.




Parameter	Select ON or OFF
Current Time	05/01/27 THU 13:50
Key Lock	OFF
Output Hold	ON Previous value
Reset Av. Output	Reset
Response Time	
Average Period	
Backlight Timer	<b>ON</b> 5 min
To Maintenance Mode	0000

### Maintenance mode


Enter the password and then press the **ENT** key to enter the maintenance mode. The password can be set by the password setting in maintenance mode. Default password setting at the time of delivery from the factory is "0000." You can enter the maintenance mode with the value before it is changed.

## 6.8 Maintenance mode

This mode is used for check of sensor input values, display of error log files or setting of passwords, etc. First, enter a password and then use it from the next operation. This mode is displayed by selecting the Maintenance Mode from “Item 6.7 Parameter Setting.”

- (1) Select the Maintenance mode from the Parameter Setting screen to display the Password Setting screen.
- (2) Enter the password, and the Maintenance Mode item selection screen will be displayed. Point the cursor to the item you want to set by pressing the  or  key and press the  key.
- (3) Next, each Maintenance screen is displayed.

**Note) “To Factory Mode” is used for our service engineers only. Refrain from using this mode.**

- (4) Press the  key to return to the Maintenance Mode item selection screen from each screen.

- **Sensor Input Value screen**


### Description of Sensor Input Value screen

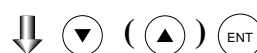
- NO<sub>x</sub> M : NO<sub>x</sub> sensor input value
- NO<sub>x</sub> C : NO<sub>x</sub> interference compensation sensor input value
- SO<sub>2</sub> M : SO<sub>2</sub> sensor input value
- SO<sub>2</sub> C : SO<sub>2</sub> interference compensation sensor input value
- CO<sub>2</sub> M : CO<sub>2</sub> sensor input value
- CO<sub>2</sub> C : CO<sub>2</sub> interference compensation sensor input value
- CO M : CO sensor input value
- CO C : CO interference compensation sensor input value
- Temperature: temperature sensor input value
- O<sub>2</sub> : O<sub>2</sub> sensor input value

- **Error Log screen**

### Description of Error Log screen


Error history. Fourteen newest errors are logged. For error number, date and time (year, month, day, period) of occurrence, channel and other details of error, refer to Item 8.1 Error message. Select Clear Error Log and press the **(ENT)** key, and the error log is cleared completely.

Maintenance Mode	Select operating item
 1. Sensor Input Value 2. Error Log 3. Cal. Log 4. Optical Adjustment 5. Interference Compensation Adj. 6. Output Adj. 7. Other Parameter 8. To Factory Mode	



### Each “Maintenance” screen

Maintenance Sensor Input			
	sensor	input	
	NO <sub>x</sub> M	648	
	C	499	
	SO <sub>2</sub> M	1518	
	C	425	
	CO <sub>2</sub> M	1120	
	C	80	
	CO M	39	
	C	80	

Maintenance Mode Error Log	ENT : Clear Error Log ESC : Back					
Error No.	Y	M	D	H	M	Ch
No. 4	04	2	11	18	10	5
No. 1	04	1	10	12	2	1
No. 6	03	12	1	10	10	2
No. 9	03	12	1	10	10	2
No. 5	03	12	1	0	0	2
No. 9	03	12	1	0	0	2
Next page						Page 1
 Clear Error Log						

## • Calibration Log screen

### Description of Calibration Log screen

Past calibration history.

Sensor input value, concentration value, and the date when zero/span calibration is performed are logged. The 10 newest calibration data is logged by each component.

Move the cursor to Clear Calibration Log and press the **ENT** key, and the calibration log is cleared completely.

Z1 : Zero calibration (Z) of Range 1

S1 : Span calibration (S) of Range 1

M : Value of measuring detector at the time of calibration

C : Value of the interference compensation detector at the time of calibration

Con : Concentration value displayed before calibration

Maintenance Cal. Log	Select Ch No.
<div> <div></div> <div>Ch1 NOx</div> </div> <div> <div></div> <div>Ch2 SO<sub>2</sub></div> </div> <div> <div></div> <div>Ch3 CO<sub>2</sub></div> </div> <div> <div></div> <div>Ch4 CO</div> </div> <div> <div></div> <div>Ch5 O<sub>2</sub></div> </div>	
Clear Error Log	



Maintenance Cal. Log Ch1 NOx					
R	M	C	Con	Y D H M	
Z1	00023	00045	-0.2	12111810	
S1	05439	01254	189.5	12111810	


## Caution

If the following operation is maladjusted, the measurement may be adversely and excessively affected. Carry out the operation with utmost attention.

## • Optical adjustment screen

For details of this item, refer to “Item 7.3.3 Optical zero adjustment method”.

Press **ENT** key and turn ON the solenoid valve signal for each calibration gas by using the **▲** or **▼** key.





Maintenance Optical Adj.		ENT : Selectable flow gas	
1-1	9	2-1	24
	3		1
1-2	21	2-2	40
	27		80
<div><div></div><div>GAS</div><div>Sample</div></div>			




- **Moisture interference adjustment screen**

For details of this item, refer to “Item 7.3.4 Moisture interference adjustment method.”

**Description of moisture interference adjustment screen**


In values on the left side of screen, the moisture interference for each component is already offset. The figures at right are interference compensation coefficients.

Move the  cursor to a desired Ch (component) by pressing the  or the  key, and then press the  key, and the selected value at right is highlighted.

Check that the gas for moisture interference compensation is flowing, change the moisture interference compensation coefficient using the  or the  key, adjust the value at left so that it becomes near zero, and then press the  key to log moisture interference compensation value.

**Caution**

**Since an interference compensation detector is not provided if the 1st range is beyond 0 to 10 vol%, no interference adjustment can be performed (no need).**

Maintenance	Select Ch No. with UP / DOWN and ENT Back with ESC		
 Ch1	NO <sub>x</sub>	10	1.252
Ch2	SO <sub>2</sub>	-33	0.983
Ch3	CO <sub>2</sub>	13	0.000
Ch4	CO	20	1.922
ALL			
Valve OFF			







Maintenance	Adjust with UP / DOWN ENT : Memorized ESC : Back		
Ch1	NO <sub>x</sub>	0	1.263
Ch2	SO <sub>2</sub>	-33	0.983
Ch3	CO <sub>2</sub>	13	0.000
Ch4	CO	20	1.922
ALL			
Valve OFF			







## • Output adjustment screen

### Description of output adjustment screen

Analog output adjustment screen.  
Connect the digital multi meter to the output terminal corresponding to the number of OUT to be adjusted, and adjust the value so that 4mA or 0V is output at zero and 20mA or 1V is output at span.

Move the cursor using the , , or the  key to the output (OUT No. and zero/span) to be adjusted, and then press the  key.

The selected value is highlighted. Adjust the value, while watching the output, by pressing the  or the  key. Press the  key to select the next digit.

On completion of the adjustment, press the  key.

Maintenance Mode Output Adj.			Adjust OUTPUT ZERO and SPAN		
OUT	Zero	Span	OUT	Zero	Span
1	01245	11845	7	01900	12500
2	01245	11845	8	01900	12500
3	01245	11845	9	01900	12500
4	01245	11845	10	01900	12500
5	01245	11845	11	01900	12500
6	01245	11845	12	01900	12500



Maintenance Mode Output Adj.			Zero / Span adjustment		
OUT	Zero	Span	OUT	Zero	Span
1	01245	11845	7	01900	12500
2	01245	11845	8	01900	12500
3	01245	11845	9	01900	12500
4	01245	11845	10	01900	12500
5	01245	11845	11	01900	12500
6	01245	11845	12	01900	12500

• Other parameter

Description of each setting screen

**Password Set** : Set the password used to move from the parameter setting screen to the maintenance mode.

Arbitrary 4-digit number can be selected.

**O2 ref. Value**

: Set the oxygen concentration reference value at the time of oxygen conversion calculation. Settable in the range from 00 to 19%.



**Limit** : Set the oxygen concentration limit at the time of oxygen conversion calculation. Settable in the range from 01 to 20%.

\* Refer to the O2 conversion concentration value in “5.3 Outline of display screen” for oxygen conversion calculation procedure.




**Station No.** : Set the station No. for MODBUS communication. Settable in the range from 00 to 32.

**Range setting** : Moves to the screen on which measuring range is changed.

Maintenance Mode setting	Select an item
Password Set      2465 O2 ref. Value   12% O2   limit 20% O2 Station No. 01 Range setting	

Press the  or the  key to move the cursor to the item whose setting is to be changed.




The values for password, oxygen conversion, limit, and station No. are highlighted.




Press the  or the  key to change the value to desired one, and then press the  key.




**Note:** Pay attention not to forget the password. Otherwise you cannot enter the maintenance mode.

### <How to set/change the range>

The measuring range can be arbitrarily selected in the minimum and the maximum range specified at the time of purchase. The range to be used can be selected 1 or 2.

- (1) Move the cursor to the item to be set by pressing the  or the  key, and then press the  key.






- (2) Move the cursor to the Ch (component) whose setting is to be changed by pressing the  or the  key, and then press the  key.


- (3) Move the cursor to the item whose setting is to be changed by pressing the  or the  key, and then press the  key.

#### Settable range

The value for range 1 and range 2 must fall within the range from the MIN and the MAX range (including the MIN and the MAX range), and at the same time range 1 must be smaller than range 2.

The number of ranges is 1 or 2.

- (4) Press the  or the  key to change the value. Press the  key to select the next digit. In a state where the decimal point is highlighted, press the  or the  key, and the decimal point position can be changed.

- (5) When necessary change is made, press the  key.

#### Caution

Be sure to perform zero/span calibration before changing the range.

If calibration is not carried out, the measurement value may be defected.

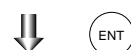
Maintenance Mode setting	Select an item
Password set 2465 O2 ref. Value 12% O2 limit 20% O2 Station No. 01 <input checked="" type="checkbox"/> Range setting	



Maintenance Mode Range set	Select Ch No.
<input checked="" type="checkbox"/> Ch1 NOx Ch2 SO2 Ch3 CO2 Ch4 CO Ch5 O2	



Maintenance Mode Range Set Ch1 NOx	Select range or range num.
MIN range 100.0 ppm Range 1 500.0 ppm Range 2 1000. ppm <input checked="" type="checkbox"/> MAX range 2000. ppm Range num. 2	







Maintenance Mode Range Set Ch1 NOx	Set range
MIN range 100.0 ppm Range 1 <b>5</b> 00.0 ppm Range 2 1000. ppm MAX range 2000. ppm Range num. 2	

## 6.9 Calibration

### 6.9.1 Zero calibration


It is used for zero point adjustment. For zero calibration gas, suited for an application should be used according to “(3) Standard gas in Item 3.3 Sampling.”

- (1) Press the  key on the Measurement screen to display the Manual Zero Calibration screen.

- (2) Select the Ch (component) to be calibrated by pressing the  or  key. After selection, press the  key, and zero gas will be supplied.


#### Caution

For the Ch (components) that is set to “both” in the “Zero Calibration” of the Calibration Setting mode, zero calibration is also carried out at the same time.






- (3) Wait until the indication is stabilized with the zero gas supplied. After the indication has been stabilized, press the  key. Zero calibration in range selected by the cursor is carried out.

**Note:** For the Ch (component) for which “AR” is selected in “6.1.1 Setting range switch mode,” the cursor automatically moves to the range selected in “Setting of auto calibration component/ range” (6.2.4), and calibration is carried out within that range.






To close “Zero Calibration”

To close the “Zero Calibration” or cancel this mode midway, press the  key. A previous screen will return.








ZERO Cal.		Select Ch No. with UP / DOWN and ENT Back with ESC	
 Ch1 NO <sub>x</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		0.0
 Ch2 SO <sub>2</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		0.0
 Ch3 CO <sub>2</sub>	▶Range1 0-10 vol% Range2 0-20 vol%		0.00
 Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm		0.0
 Ch5 O <sub>2</sub>	▶Range1 0-10 vol% ▶Range2 0-25 vol%		20.09



ZERO Cal.		Select Ch No. with UP / DOWN and ENT Back with ESC	
 Ch1 NO <sub>x</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		0.0
 Ch2 SO <sub>2</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		0.0
 Ch3 CO <sub>2</sub>	▶Range1 0-10 vol% Range2 0-20 vol%		0.00
 Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm		0.0
 Ch5 O <sub>2</sub>	▶Range1 0-10 vol% ▶Range2 0-25 vol%		20.09




ZERO Cal.		ENT : Go on calibration of selected Ch. ESC : Not calibration	
Ch1 NO <sub>x</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		0.0
Ch2 SO <sub>2</sub>	▶Range1 0-100 ppm Range2 0-2000 ppm		0.9
Ch3 CO <sub>2</sub>	▶Range1 0-10 vol% Range2 0-20 vol%		0.34
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm		1.1
Ch5 O <sub>2</sub>	▶Range1 0-10 vol% ▶Range2 0-25 vol%		20.09





To Measurement screen after  
executing Manual Zero Calibration




## 6.9.2 Span calibration

It is used to perform a span point adjustment. Supply calibration gas with concentration set to the span value to perform the span calibration. For the span calibration gas for the NO<sub>x</sub>, SO<sub>2</sub>, CO<sub>2</sub>, CO measurement, use the standard gas with a concentration of 90% or more of the range value. For the span calibration gas for the O<sub>2</sub> measurement, use the standard gas with a concentration of 90% or more of the range value when measuring with the built-in O<sub>2</sub> sensor, and use the standard gas of about 2 vol% when measuring with an external zirconia O<sub>2</sub> sensor.

- (1) Press the  key on the Measurement screen to display the Manual Span Calibration screen.


↓ 

SPAN Cal.		Select Ch No. with UP / DOWN and ENT Back with ESC	
 Ch1 NO <sub>x</sub>	▶ Range1 0-100 ppm Range2 0-2000 ppm		0.0
Ch2 SO <sub>2</sub>	▶ Range1 0-100 ppm Range2 0-2000 ppm		0.0
Ch3 CO <sub>2</sub>	▶ Range1 0-10 vol% Range2 0-20 vol%		0.00
Ch4 CO	▶ Range1 0-100 ppm Range2 0-2000 ppm		0.0
Ch5 O <sub>2</sub>	▶ Range1 0-10 vol% Range2 0-25 vol%		20.09

- (2) Select Ch (component) to be calibrated by pressing the  or  key and press the  key. The calibration gas is supplied.


### Caution






When “both” from “Calibration Range” of the Calibration Setting mode is set, span calibration is performed together with 2 Ranges.


- (3) Wait until the indication is stabilized in the state where the calibration gas is supplied. After the indication has been stabilized, press the  key. Span calibration of Range selected by the cursor is performed.


**Note:** For the Ch (component) for which “AR” is selected in “6.1.1 Setting range switch mode,” the cursor automatically moves to the range selected in “Setting of auto calibration component/range” (6.2.4), and calibration is carried out within that range.






To close "Span Calibration"


To close the “Span Calibration” or cancel this mode midway, press the  key. A previous screen will return.

↓   (  )  

SPAN Cal.		Select Ch No. with UP / DOWN and ENT Back with ESC	
Ch1 NO <sub>x</sub>	▶ Range1 0-100 ppm Range2 0-2000 ppm		0.0
 Ch2 SO <sub>2</sub>	▶ Range1 0-100 ppm Range2 0-2000 ppm		0.0
Ch3 CO <sub>2</sub>	▶ Range1 0-10 vol% Range2 0-20 vol%		0.00
Ch4 CO	▶ Range1 0-100 ppm Range2 0-2000 ppm		0.0
Ch5 O <sub>2</sub>	▶ Range1 0-10 vol% Range2 0-25 vol%		20.09

↓ 

SPAN Cal.		ENT : Go on calibration of selected Ch. ESC : Not calibration	
Ch1 NO <sub>x</sub>	▶ Range1 0-100 ppm Range2 0-2000 ppm		0.0
Ch2 SO <sub>2</sub>	▶ Range1 0-100 ppm Range2 0-2000 ppm		0.9
Ch3 CO <sub>2</sub>	▶ Range1 0-10 vol% Range2 0-20 vol%		0.34
Ch4 CO	▶ Range1 0-100 ppm Range2 0-2000 ppm		1.1
Ch5 O <sub>2</sub>	▶ Range1 0-10 vol% Range2 0-25 vol%		20.09

↓ 

**To Measurement screen after  
executing Manual Span Calibration**

## 7. MAINTENANCE

### 7.1 Daily check

#### (1) Zero calibration and span calibration

- (1) Perform zero calibration. For the calibration procedures, refer to “Item 6.9.1 Zero calibration.”
- (2) Then, perform span calibration. For the calibration procedures, refer to “Item 6.9.2 Span calibration.”
- (3) Zero calibration and span calibration should be carried out once a week, as required.

#### (2) Flow rate check

- (1) Sampling gas flow and purge gas flow are as follows:
  - Sampling gas flow: 0.5L/min±0.2L/min
  - Purge gas flow: About 1L/min
- (2) Check and maintenance should be carried out every day, as required.

### 7.2 Daily check and maintenance procedures

Table 7.1 Maintenance and check table

	Parts to be checked	Phenomena	Causes	Remedy
Daily check	Indication value	Indication values are lowered. Indication values are higherd.	(1) Dust is mixed in sampling cell.	(1) Clean the sampling cell. In addition, check sampling devices, especially gas filter.
			(2) Air is absorbed midway in the sampling pipe.	(2) Find out cause of leak and repair.
	Purge gas flow is included when purging gas in sampling gas flow rate.	Standard flow is beyond the specified flow rate of 0.5L/min, 0.3 to 0.7L/min.	_____	Adjust by needle valve of flow rater.
Weekly check	Zero point of gas analyzer	It is deflected.	_____	Adjust.
	Span point of gas analyzer	It is deflected.	_____	Adjust.
Yearly check	Gas analyzer	Regardless of any phenomena	_____	Overhaul.

## 7.3 Maintenance of analyzer unit

### 7.3.1 Cleaning method for sample cell (pipe cell)

This section is strictly factory adjusted. Handle it with utmost attention.

If it is absolutely required, contact us.

- (1) Turn off the power switch, stop the sample gas, and allow the zero gas to flow for several minutes to purge the cell interior.

Loosen the setscrew (2 pieces) from the top cover and remove it.

- (2) Remove the internal gas inlet tube.
- (3) Loosen both right and left screws for cell holding plate.

- Remove the sample cell only.

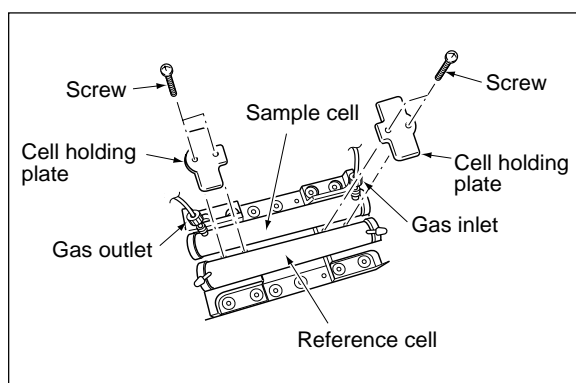
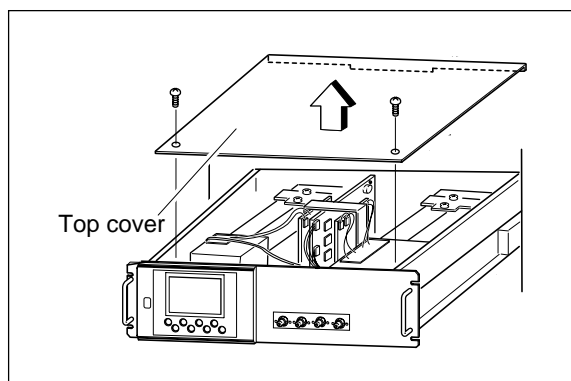
- (4) Turn to the left the sample cell window and remove it from the sample cell (see Fig. 7-1).

- (5) For cleaning the window and cell inside surface, first eliminate coarse dust by soft brush or the like and then wipe them by soft rag.

The window is easy to get scratched. Pay utmost attention so as not to damage it.

- (6) After the end of sample cell cleaning, mount the cell in place and proceed to running.

After cleaning sample cell, be sure to perform optical zero adjustment (see Item 7.3.3) and moisture interference compensation adjustment (see Item 7.3.4).



#### Caution

If the window or the cell interior is very dirty, use a soft cloth moistened with absolute alcohol. A slightly corroded infrared transmission window or sample cell can be remedied by gently rubbing with chromium oxide powder on cleaning cloth but an excessively corroded one must be replaced. When cleaning, do not exert an excessive stress.

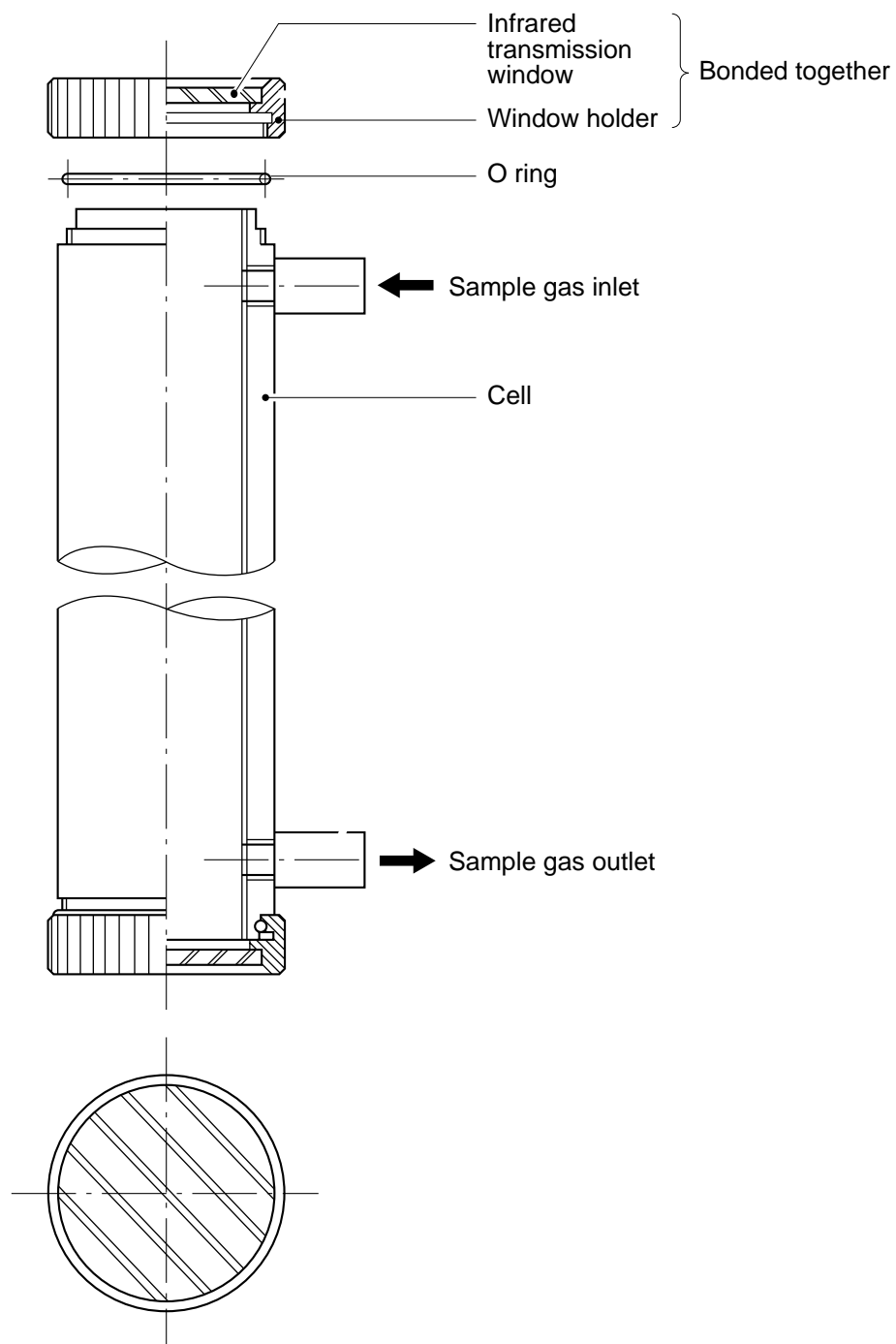


Fig. 7-1 Structure of sample cell (pipe cell)



### 7.3.2 Cleaning method for sample cell (block cell)

- (1) Turn off the power switch, stop the sample gas, and allow the zero gas to flow for several minutes to purge the cell interior.

Loosen the setscrew (2 pieces) from the top cover and remove it.

- (2) Remove the internal gas inlet tube.
- (3) Loosen the 2 detector set bolts.

**Note) The distribution cell, block cell and detector are fastened by the same bolts.**

- (4) Using the furnished cell mounting tool, turn the window fixture to the left and remove it from the cell.

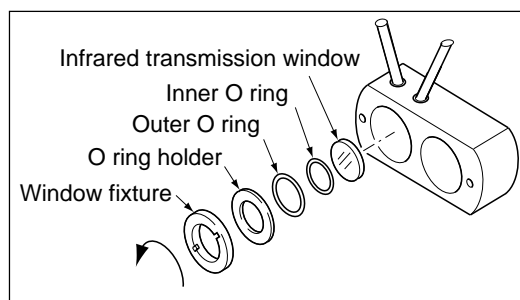
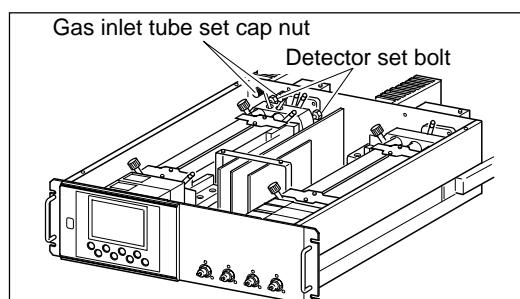
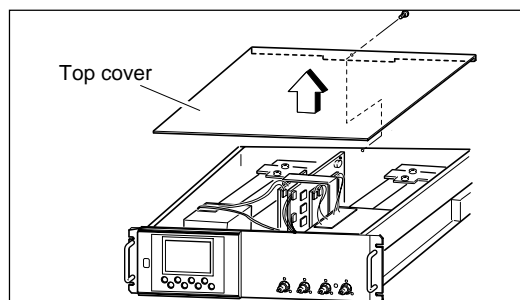
(See the structure of sample cell (block cell) in Fig. 7-2.)

- (5) For cleaning the infrared transmission window and cell inside surface, first eliminate coarse dust by soft brush or the like and then wipe them by soft rag.

The window is easy to get scratched. Pay utmost attention so as not to damage it.

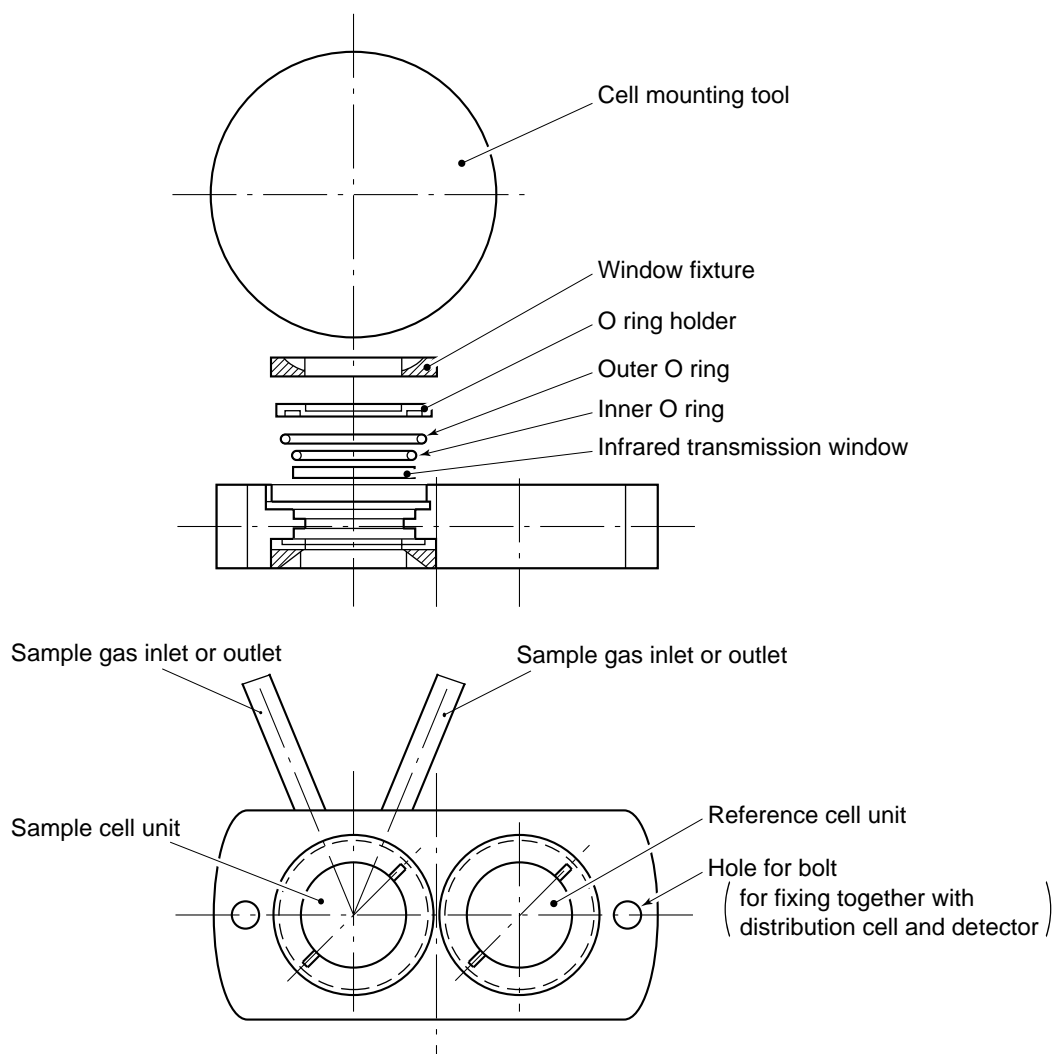
- (6) After the end of sample cell cleaning, mount the cell in place and proceed to running.

After cleaning sample cell, be sure to perform optical zero adjustment (see Item 7.3.3) and moisture interference compensation adjustment (see Item 7.3.4).



#### Caution

If the window or the cell interior is very dirty, use a soft cloth moistened with absolute alcohol. A slightly corroded infrared transmission window or sample cell can be remedied by gently rubbing with chromium oxide powder on cleaning cloth but an excessively corroded one must be replaced. When cleaning, do not exert an excessive stress.



Structure of sample cell (of 32, 16, 8, 4, 2 mm long)  
(sample cell and reference cell are integrated)

**Note) Use the dedicated cell mounting tool (furnished).**

Fig. 7-2 Structure of sample cell (block cell)

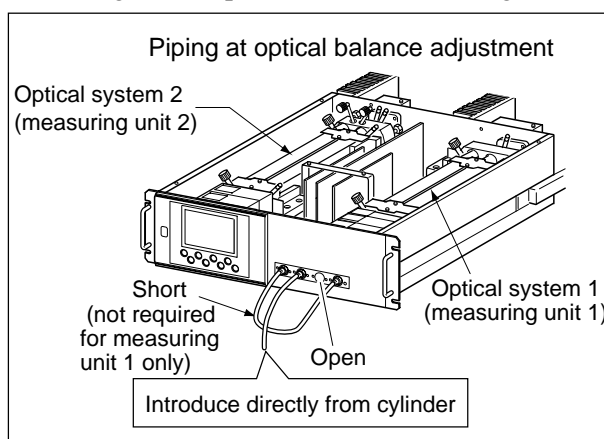
### 7.3.3 Optical zero adjustment method (optical balance adjustment)

#### Caution

If the following operation is maladjusted, the measurement may adversely be affected. If you are not trained for adjustment, do not carry out this operation but contact the distributor or our service-man.

The adjustment is performed at reassembly after removing the sample cell, etc. for cleaning, etc.

- (1) Remove the top cover. Allow dry N<sub>2</sub> or air to flow through the analyzer unit sample gas inlet until the reading stabilizes. The sample gas is introduced directly to the INLET of analyzer unit through the gas cylinder.
- (2) Proceed to an optical adjustment in the maintenance mode. The display on the operation panel of the main unit is as illustrated on the right. Balance adjustment is not required if the display falls within  $\pm 100$ .



Maintenance Optical Adj.		Press the ENT key to feed zero gas Set zero gas	
(a)			(e)
(b)	1-1	30	2-1
		50	
(c)	1-2	20	2-2
(d)		-10	
			(f)
			60
			0
			(g)
			-30
			(h)
			-20
■ GAS Sample			

#### <Correspondence between measurement detector and indicated position>

No. of components to be measured		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1-component meter		Main	Comp	-	-	-	-	-	-
2-component analyzer	NO/SO <sub>2</sub>	NO Main	NO Comp	SO <sub>2</sub> Main	SO <sub>2</sub> Comp	-	-	-	-
	CO <sub>2</sub> /CO	CO <sub>2</sub> Main	CO <sub>2</sub> Comp	CO Main	CO Comp	-	-	-	-
	NO/CO	NO Main	NO Comp	-	-	CO Main	CO Comp	-	-
	N <sub>2</sub> O/CO <sub>2</sub>	N <sub>2</sub> O Main	N <sub>2</sub> O Comp	CO <sub>2</sub> Main	-	-	-	-	-
3-component analyzer	NO/SO <sub>2</sub> /CO	NO Main	NO Comp	SO <sub>2</sub> Main	SO <sub>2</sub> Comp	CO Main	CO Comp	-	-
	NO/N <sub>2</sub> O/CO <sub>2</sub>	NO Main	NO Comp	-	-	N <sub>2</sub> O Main	N <sub>2</sub> O Comp	CO <sub>2</sub> Main	-
	SO <sub>2</sub> /N <sub>2</sub> O/CO <sub>2</sub>	SO <sub>2</sub> Main	SO <sub>2</sub> Comp	-	-	N <sub>2</sub> O Main	N <sub>2</sub> O Comp	CO <sub>2</sub> Main	-
	N <sub>2</sub> O/CO <sub>2</sub> /CO	N <sub>2</sub> O Main	N <sub>2</sub> O Comp	CO <sub>2</sub> Main	-	CO Main	CO Comp	-	-
	CH <sub>4</sub> /N <sub>2</sub> O/CO <sub>2</sub>	CH <sub>4</sub> Main	CH <sub>4</sub> Comp	-	-	N <sub>2</sub> O Main	N <sub>2</sub> O Comp	CO <sub>2</sub> Main	-
4-component analyzer	NO/SO <sub>2</sub> /CO <sub>2</sub> /CO	NO Main	NO Comp	SO <sub>2</sub> Main	SO <sub>2</sub> Comp	CO <sub>2</sub> Main	-	CO Main	CO Comp
	NO/SO <sub>2</sub> /N <sub>2</sub> O/CO <sub>2</sub>	NO Main	NO Comp	SO <sub>2</sub> Main	SO <sub>2</sub> Comp	N <sub>2</sub> O Main	N <sub>2</sub> O Comp	CO <sub>2</sub> Main	-

\* O<sub>2</sub> is excluded from the number of components.

\* "Main" is signal input value from the main detector of each component.

"Comp" is signal input value from interference compensation detector of each component.

If low range exceeds the range of 0 to 10vol%, detector signal of "comp" is not usable.

Sensor values of which are not included in measuring components should be ignored.

(3) Carry out the adjustment in the procedure in (4) and subsequent.

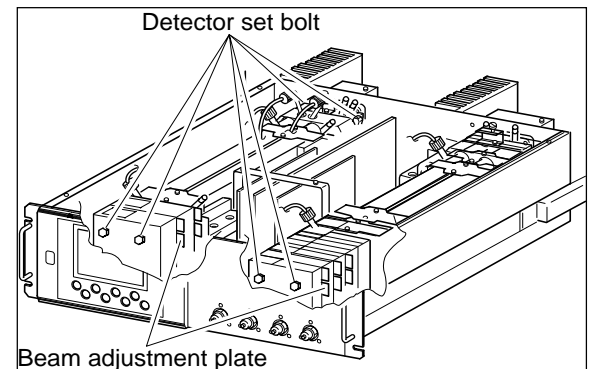
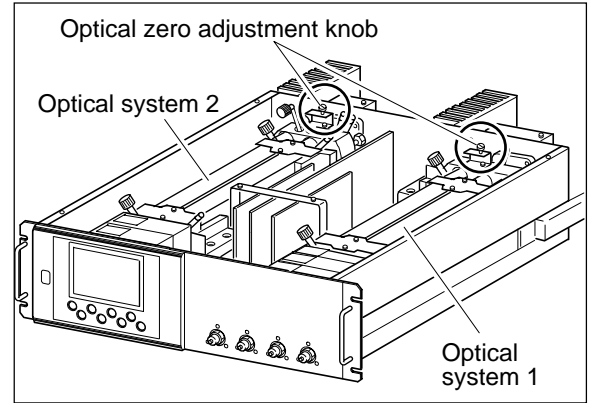
- Adjust on the primary side of the optical system so that the values for ㉑ to ㉔ in 1-1 and 1-2 become as close to 0 as possible within  $\pm 100$  range.
- Adjust on the secondary side of the optical system so that the values for ㊸ to ㊻ in 2-1 and 2-2 become as close to 0 as possible within  $\pm 100$  range.

- (4) Operate the optical zero adjustment knob to change the value displayed at ㉑ (or ㊸).
- (5) Move the beam adjustment plate sideview to change the value displayed at ㉒ (or ㉕).
- (6) Move the beam adjustment plate sidewise to change the value displayed at ㉓ (or ㉖).
- (7) Move the beam adjustment plate sidewise to change the value displayed at ㉔ (or ㉗).
- (8) Repeat the procedures in (4) to (7) to make all the displayed values come close to 0 as possible within  $\pm 100$  range.

**\* Adjust the beam adjustment plate which is the nearest to the zero adjustment knob first, and sequentially.**

(9) After the optical balance adjustment, mount the top cover of the analyzer unit, then carry out a moisture interference compensation adjustment, and perform zero and span calibrations.

**\* Before moving the beam adjustment plate, loosen the detector set bolts (just enough to make the plate movable for snug adjustment).**



### 7.3.4 Moisture interference compensation adjustment method

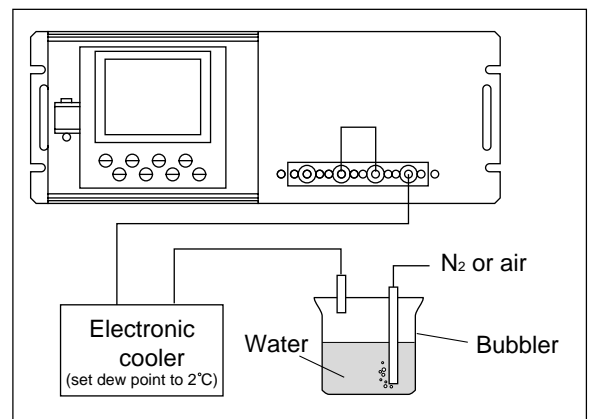
#### Caution






If the following operation is maladjusted, the measurement may adversely be affected. If you are not trained for adjustment, do not carry out this operation but contact the distributor or our service-man.


Proceed to an adjustment if excessively (beyond  $\pm 2\%$  FS) affected by moisture interference.

After the end of optical balance adjustment, be sure to carry out moisture interference compensation adjustment.

- (1) After warm-up, select the low range, allow dry gas ( $N_2$ , air) to flow at 0.5 L/min and carry out zero calibration.




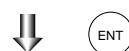
- (2) Display the moisture interference compensation screen of the analyzer unit (see “6.8 Maintenance mode”). Set the dew point to 2°C by using an electronic cooler, and introduce bubbled N<sub>2</sub> or air gas to the analyzer (shown on the figure).
- (3) On the screen, select a desired Ch (component) by pressing the  key, adjust the value at right by pressing the  or the  key so that the value at left falls within ±10 (make it as close to 0 as possible), and then press the  key to memorize the value. (Exiting by “” cancels the adjustment.)

Or, selecting the “ALL” and pressing the “” key, zeroes all components integrally.

(First, adjust all components by selecting ALL and then perform fine adjustment for components one by one using UP and DOWN keys.)

\* If any components exceed the range of 0 to 10vol%, no adjustment can be performed (No interference compensation is required).

Moisture interference Compensation Adj.		Select Ch No. with UP / DOWN and ENT Back with ESC	
 Ch1	NO <sub>x</sub>	10	1.252
Ch2	SO <sub>2</sub>	-33	0.983
Ch3	CO <sub>2</sub>	13	0.000
Ch4	CO	20	1.922
ALL			
Valve OFF			



Moisture interference Compensation Adj.		Adjust with UP / DOWN ENT : Memorized ESC : Back	
Ch1	NO <sub>x</sub>	10	1.252
Ch2	SO <sub>2</sub>	-33	0.983
Ch3	CO <sub>2</sub>	13	0.000
Ch4	CO	20	1.922
ALL			
Valve OFF			

## 8 ERROR MESSAGE

If errors occur, the following contents are displayed.

Error display	Error contents	Probable causes
Error No.1	Motor rotation detection signal faulty	<ul style="list-style-type: none"> <li>• Motor rotation is faulty or stopped.</li> <li>• Motor rotation detector circuit is faulty.</li> </ul> <p>Note) Sector motor is a consumption part. It is recommendable to exchange the motor once two years.</p>
Error No.4	Zero calibration is not within.	<ul style="list-style-type: none"> <li>• Zero gas is not supplied.</li> <li>• Zero is deflected much due to dirty cell.</li> <li>• Detector is faulty.</li> <li>• Optical balance is maladjusted.</li> </ul>
Error No.5	Amount of zero calibration (indication value) is over 50% of full scale.	
Error No.6	Span calibration is not within the allowable range.	<ul style="list-style-type: none"> <li>• Span gas is not supplied.</li> <li>• Calibrated concentration setting does not match cylinder concentration.</li> <li>• Zero calibration is not performed normally.</li> <li>• Span is deflected much due to dirty cell.</li> <li>• Detector sensitivity has deteriorated.</li> </ul>
Error No.7	Amount of span calibration (difference between indication value and calibrated concentration) is over 50% of full scale.	
Error No.8	Measured values fluctuate too much during zero and span calibration.	<ul style="list-style-type: none"> <li>• Calibration gas is not supplied.</li> <li>• Time for flowing calibration gas is short.</li> </ul>
Error No.9	Calibration is abnormal during auto calibration.	<ul style="list-style-type: none"> <li>• Error corresponding to No. 4 to No. 8 occurred during auto calibration.</li> </ul>
Error No.10	Output cable connection is improper.	<ul style="list-style-type: none"> <li>• Wiring is detached between analyzer and interface module.</li> <li>• Wiring is disconnected between analyzer and interface module.</li> </ul>

When errors No. 1 and No. 10 occur, analyzing block error contact output is closed.



When errors No. 4 to No. 9 occurs, calibration error contact output is closed.

### Screen display and operation at the occurrence of error

In case of Error No. 1 to No. 4, No. 6, No. 8 to No. 10


Measurement screen

1	Error No.9	00.8
2	SO <sub>2</sub>	13.6
3	CO <sub>2</sub>	0.000
4	CO	0.0
5	O <sub>2</sub>	21.00

- Press the  key to delete the error display.
- If the  key is pressed without removing the cause of an error, the error will be displayed again.

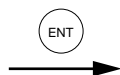
Display of error contents

Error No.9	Auto Cal. error ESC:Back to MEAS.
SPAN NOX Calibration error Cause <ul style="list-style-type: none"> <li>• Calibration gas is not flowing</li> <li>• Gas flowing time is short</li> <li>• Setting conc. is different from gas conc.</li> <li>• Dirt in sample cell</li> </ul>	

- When more than one error occurs, pressing the  key moves to another error display.

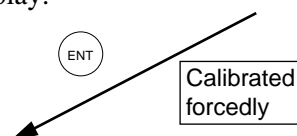
### In case of Error No. 5 and No. 7

ZERO cal.		ENT:Go on calibration of selected CH ESC:Not calibration	
Ch1 NO <sub>x</sub>	▶ Error No. 5	ppm ppm	3083
Ch2 SO <sub>2</sub>	▶ Range1 0-100 Range2 0-2000	ppm ppm	-13.6
Ch3 CO <sub>2</sub>	▶ Range1 0-10 Range2 0-20	vol% vol%	-0.006
Ch4 CO	▶ Range1 0-100 Range2 0-2000	ppm ppm	0.2
Ch5 O <sub>2</sub>	▶ Range1 0-10 Range2 0-25	vol% vol%	-0.09



Error No. 5	SPAN cal. error ENT:Force Cal. ESC:Stop cal. and back to MEAS.
NO <sub>x</sub> Calibration error Cause <ul style="list-style-type: none"> <li>• Span gas is not flowing</li> <li>• Deviation of zero point due to contamination</li> <li>• Low sensitivity of detector</li> </ul>	

- Pressing delete the error display.



Calibration is continued. Unless another calibration error occurs, calibration is carried out to the end, the Measurement screen returns.



Ch1	NO <sub>2</sub> 0-25	90.8 ppm
Ch2	SO <sub>2</sub> 0-100	13.6 ppm
Ch3	CO <sub>2</sub> 0-10	0.000 vol%
Ch4	CO 0-100	0.0 ppm
Ch5	O <sub>2</sub> 0-25	0.09 vol%

## Error log file

If error occurs, the history is saved in an error log file. The error log file exists in the maintenance mode.

### Error log screen

Maintenance Mode Error Log		ENT : Clear Error Log ESC : Back				
Error No.	Y	M	D	H	M	Ch
No. 4	04	2	11	18	10	5
No. 1	04	1	10	12	2	1
No. 6	03	12	1	10	10	2
No. 9	03	12	1	10	10	2
No. 5	03	12	1	0	0	2
No. 9	03	12	1	0	0	2
Next page			Page 1			
Clear Error Log						

Errors that occurred

Date and time when an error occurred.

Component with which the error occurred.

New

Old

Errors that occurred

Date and time when an error occurred.

Component with which the error occurred.

New  
↓  
Old

\* Up to 14 errors can be saved in the error history; the oldest error will be deleted one by one every time a new occurs.

\* If the power supply is turned OFF, the contents in the error log file will not be lost or damaged.

## Deletion of error history

Press the key on the above screen, and the “Error Log Clear” will be inverted. Further pressing the key will clear the error history.

## 9. SPECIFICATIONS

### 9.1 General specifications

#### 1. Standard specifications

##### Measurable gas components and measuring range:

	Minimum range	Maximum range
NO	0 – 50ppm	0 – 5000ppm
SO <sub>2</sub>	0 – 50ppm	0 – 10vol%
CO <sub>2</sub>	0 – 20ppm	0 – 100vol%
CO	0 – 50ppm	0 – 100vol%
CH <sub>4</sub>	0 – 200ppm	0 – 100vol%
N <sub>2</sub> O	0 – 200ppm	0 – 2000ppm
O <sub>2</sub> (built in)	0 – 5vol%	0 – 25vol%
O <sub>2</sub> (External Zirconia)	0 – 5vol%	0 – 25vol%

- Max. 5 components measurement including O<sub>2</sub>.
- Measuring range ratio  $\leq 1:5$  (O<sub>2</sub>)  
 $\leq 1:25$   
(except for O<sub>2</sub>)
- Measuring ranges are changeable between the specified minimum and maximum range  
Settable one range or two ranges
- When only N<sub>2</sub>O analyzer is used, make sure not to contain any components other than N<sub>2</sub>O.  
Multicomponent analyzers including N<sub>2</sub>O analyzer + CO<sub>2</sub> analyzer are used for sludge incineration.  
In this case, the range of N<sub>2</sub>O is 0 to 200ppm/500ppm, and the range of CO<sub>2</sub> is 0 to 10%/20%.

##### Principle of measurement:

No, SO<sub>2</sub>, CO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub>O ;

Non-dispersion infrared-ray absorption method  
Single light source and double beams (double-beam system)

O<sub>2</sub> ; Paramagnetic O<sub>2</sub> sensor (built in) or zirconia O<sub>2</sub> sensor (externally installed)

##### Measured value indication:

- Digital indication in 4 digits  
(LCD with back light)
- Instantaneous value of each component
  - Instantaneous value after O<sub>2</sub> conversion  
(only in NO, SO<sub>2</sub>, CO measurement with O<sub>2</sub>)
  - Average value after O<sub>2</sub> conversion  
(only in NO, SO<sub>2</sub>, CO measurement with O<sub>2</sub>)
  - O<sub>2</sub> average value

##### Analog output signals:

- \* Inputs/outputs of analog signals are possible by combining with the input/output terminal module.
- 4 to 20mA DC or 0 to 1V DC, non-isolated output ; 12 points max.
- max.load 550Ω. for 4 to 20 mA DC
- min.load 100kΩ. for 0 to 1V DC
- \* Refer to Table 2, for the channel No. of

displayed values and analog output signals.

##### Analog input signal:

For signal input from externally installed O<sub>2</sub> sensor.

Signal requirement;

(1) Signal from Fuji's Zirconia O<sub>2</sub> sensor (TYPE: ZFK7)

(2) 0 to 1V DC from an O<sub>2</sub> sensor

Input section is not isolated. This feature is effective when an O<sub>2</sub> sensor is not built in.

(Depend on O<sub>2</sub> input signal, measured concentration indication and O<sub>2</sub> conversion.)

##### Relay Contact output:

1a contact (250V AC/2A, resistive load)

Instrument error, calibration error, range identification, auto calibration status, pump ON/OFF, peak alarm.

1c contact (250V AC/2A, resistive load selectable 6 outputs)

High/Low limit alarm contact output.

Power disconnection alarm.

\* All relay contacts are isolated mutually and from the internal circuit.

**Contact input:** No-voltage contact (ON/0V, OFF/5V DC, 5mA flowing at ON)

Remote range switch, auto calibration remote start, remote holding, average value resetting, pump ON/OFF

Isolated from the internal circuit with photocoupler. Contact inputs are not isolated from one another.

##### Transmission output:

Solenoid valve drive signal for automatic calibration.

Transistor output (100mA or less)

**Power supply:** Voltage rating ; 100V to 240V AC

Allowable range ; 85V to 264V AC

Frequency ; 50Hz/60Hz

Power consumption; 250VA max.

Inlet ; Conform to EN60320  
Protection Class 1

##### Operation conditions:

Ambient temperature ; -5°C to 45°C

Ambient humidity ; 90% RH max.,  
non-condensing

##### Storage conditions:

Ambient temperature ; -20°C to 60°C

Ambient humidity ; 100% RH max.,  
non-condensing

##### Dimensions (H × W × D):

Analyzer main unit;

177 x 483 x 600mm

Input/output terminal module;

164 x 318 x 55mm

**Mass:** Approx. 22 kg (only Analyzer)

**Finish color:** Front panel ; Off-white (Munsell 10Y7.5/  
0.5 or equivalent)

Casing; Steel-blue (gray)

**Enclosure:** Steel casing, for indoor use



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**Material of gas-contacting parts:**

Gas inlet/outlet; SUS304  
Sample cell; SUS304, chloroprene rubber  
Infrared-ray transmitting window; CaF<sub>2</sub>  
O<sub>2</sub> sensor sample cell : SUS316  
Internal piping; Toaron, Teflon

**Gas inlet/outlet:** Rc1/4 or NPT1/4 internal thread

**Purge gas flow rate:** 1L/min ( when required)

## 2. Standard Functions

**Output signal holding:**

Output signals are held during manual and auto calibrations by activation of holding (turning "ON" its setting).  
The values to be held are the ones just before start calibration mode or setting value. It is selectable.  
Indication of instantaneous values will not be held.

**Remote output holding:**

Output signal is held at the latest value or setting value by short-circuiting the remote output holding input terminals.  
Holding is maintained while the terminals are short-circuited. Indication of instantaneous values will not be held.

**Switch ranges:**

The switch ranges is available in manual, auto, and remote modes. Only preset switch method is effective.

Manual: Allows range to switch by key operation.

Auto: Allows range to switch from low to high range when 90%FS or more is available in the low range.  
Allows range to switch from high to low range when 80%FS or less is available in the low range.

Remote: No-voltage contact input (for measurable components)  
Allows range to switch via an external signal when remote range switch input is received.

When the contact input terminals for each component are short-circuited, the first range is selected, and it is switched to the second range when the terminals are open.

**Range identification signal:**

The present measuring range is identified by a contact signal.

The contact output terminals for each component are short-circuited when the first range is selected, and when the second range is selected, the terminals are open.

**Auto calibration:**

Auto calibration is carried out periodically at the preset cycle.

When a standard gas cylinder for calibration and a solenoid valve for opening/closing the gas flow line are prepared externally by the customer, calibration will be carried out with the solenoid valve drive contacts for zero calibration and each span calibration turned on/off sequentially at the set auto calibration timing.

**Auto calibration cycle setting:**

Auto calibration cycle is set.

Setting is variable within 1 to 99 hours (in increments of 1 hour) or 1 to 40 days (in increments of 1 day).

**Gas flow time setting:**

The time for flowing each calibration gas in auto calibration is set.

Settable within 60 to 900 seconds (in increments of 1 second)

**Auto calibration remote start:**

Auto calibration is carried out only once according to an external input signal. Calibration sequence is settable in the same way as the general auto calibration. Auto calibration is started by opening the auto calibration remote start input terminals after short-circuiting for 1.5 seconds or longer.

**Auto zero calibration:**

Auto zero calibration is carried out periodically at the preset cycle.

This cycle is independent on "Auto calibration" cycle.

When zero calibration gas and solenoid valve for opening/closing the calibration gas flow line are prepared externally by the customer, zero calibration will be carried out with the solenoid valve drive contact for zero calibration turned on/off at the set auto zero calibration timing.

**Auto zero calibration cycle setting:**

Auto zero calibration cycle is set.

Setting is variable within 1 to 99 hours (in increments of 1 hour) or Setting is variable within 1 to 40 days (in increments of 1 day)

**Gas flow time setting:**

The timing for flowing zero gas in auto zero calibration is set.

Settable 60 to 900 seconds (in increments of 1 second)

**Upper/lower limit alarm:**

Alarm contact output turns on when measurement value reach to the preset high or low limit alarm value.

Contacts close when the channel value of each channel becomes larger than the high alarm limit value or smaller than the low alarm limit value.

**Instrument error contact output:**

Contacts close at occurrence of analyzer error No. 1, 3 or 10.

**Calibration error contact output:**

Contacts close at occurrence of manual or auto calibration error (any of errors No. 4 to 9).

**Auto calibration status contact outputs:**

Contacts close during auto calibration.

**Pump ON/OFF contact output:**

During measurement, this contact close. While calibration gas is flowing, this contact open. This contact is connected in power supply of pump, and stop the sample gas while calibration gas flowing.

### 3. Optional function

**O<sub>2</sub> conversion:** Conversion of measured NO, SO<sub>2</sub> and CO gas concentrations into values at reference O<sub>2</sub> concentration

Conversion formula:

$$C = \frac{21 - O_n}{21 - O_s} \times C_s$$

C : Sample gas concentration after O<sub>2</sub> conversion

C<sub>s</sub> : Measured concentration of sample gas

O<sub>s</sub> : Measured O<sub>2</sub> concentration (Limit setting: 1 to 20% O<sub>2</sub>)

O<sub>n</sub> : Reference O<sub>2</sub> concentration (value changeable by setting 0 to 19% O<sub>2</sub>)

**Average value after O<sub>2</sub> conversion and O<sub>2</sub> average value calculation:**

The result of O<sub>2</sub> conversion or instantaneous O<sub>2</sub> value can be outputted as an average value in the preset period of time. Used for averaging is the moving average method in which sampling is carried out at intervals of 30 seconds.

(Output is updated every 30 seconds. It is the average value in the determined period of time just before the latest updating.)

Averaging time is settable within 1 to 59 minutes (in increments of 1 minute) or 1 to 4 hours (in increments of 1 hour).

**Average value resetting:**

The above-mentioned output of average value is started from the initial state by opening the average value resetting input terminals after short-circuiting for 1.5 seconds or longer.

Output is reset by short-circuiting and restarted by opening

**CO concentration peak count alarm:**

(added only for CO/O<sub>2</sub> measurement)

Alarm output turns on according to the preset concentration and count.

Whenever the instantaneous value of CO exceeds the preset concentration value, count increments. If the count exceeds the preset value in one hour, the alarm contacts close.

**Communication function:**

RS-232C (9pins D-sub)

Half-duplex bit serial

Start-stop synchronization

Modbus™ protocol

Contents : Read/Wright parameters

Read measurement concentration and instrument status

Remark : When connecting via RS-485 interface, a RS-232C ↔ RS-485 converter should be used.

### 4. Performance

Repeatability : ±0.5% of full scale

Linearity : ±1% of full scale

Zero drift : ±1% of full scale/week

(±2% of full scale/week; range between 0 to 50ppm and 0 to 200ppm)

(±2% of full scale/day; smaller than 0 to 50ppm range)

Span drift : ±2% of full scale/week

(±2% of full scale/day; smaller than 0 to 50ppm range)

Response time (for 90% FS response) :

15 sec electrical response

Within 60 seconds including replacement time of sampling gas (when gas flow rate is 0.5L/min)

Gas replacement time depends on the number of measuring components, and measuring range

### 5. Standard Requirements for Sample Gas

Flow rate : 0.5L / min ± 0.2L / min

Temperature : 0 to 50°C

Pressure : 10 kPa or less (Gas outlet side should be open to the atmospheric air.)

Dust : 100µg/Nm<sup>3</sup> in particle size of 1µm or less

Mist : Unallowable

Moisture : Below a level where saturation occurs at 2°C (condensation unallowable).

Corrosive component:

1 ppm or less

Standard gas for calibration:

Zero gas ; Dry N<sub>2</sub>

Span gas ; Each sample gas having concentration 90 to 100% of its measuring range (recommended). Gas beyond concentration 100%FS is unusable.

In case a zirconia O<sub>2</sub> analyzer is installed externally and calibration is carried out on the same calibration gas line:

Zero gas ; Dry air or atmospheric air (provided without CO<sub>2</sub> sensor)

Span gas ; For other than O<sub>2</sub> measurement, each sample gas having concentration 90 to 100% of its measuring range.

For O<sub>2</sub> measurement, O<sub>2</sub> gas of 1 to 2 vol%.

---

## 6. Installation Requirements

- Indoor use. (Select a place where the equipment does not receive direct sunshine, draft/rain or radiation from hot substances. If such a place cannot be found, a roof or cover should be prepared for protection.)
- Avoid a place where receives heavy vibration.
- Select a place where atmospheric air is clean.

## 7. EC Directive Compliance

The product conforms to the requirements of the Low Voltage Directive 73/23/EEC and EMC directive 89/336/EEC (as amended by Directive 92/31/EEC), both as amended by Directive 93/68/EEC.

It conforms to following standards for product safety and electromagnetic compatibility ;

EN61010-1 : 2001 Safety requirements for electrical equipment for measurement, control and laboratory use.  
"Installation Category II"  
"Pollution Degree 2"

EN61326-1 : 1997, A1: 1998, A2: 2001  
Electrical equipment for measurement, control and laboratory use — EMC requirements.

\* The product mounted in a steel enclosure conforms to the requirements of EMC directive.

Basic type: ZKJ □□□□ 4- □□□□□□ - □□□□□□ - □□□

Digit	Description																																																	
Z	K	J	F	E	L	M	N	P	R	S	T	V	X	-	A	B	C	D	G	H	I	O	U	W	Y	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	-	21	22	23

← Digit No.  
of code.

INZ-TN4ZKJ-E

Digit	Description	note	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Digit No. of code
17	<Measuring range> 4th component	note 4	Z	K	J	F				4																
18	Minimum range	Maximum range																								
	None	None																	Y	Y						
	0 to 50ppm	0 to 1000ppm																	A	F						
	0 to 100ppm	0 to 2000ppm																	B	G						
	0 to 200ppm	0 to 500ppm																	C	E						
	0 to 200ppm	0 to 200ppm																	C	G						
	0 to 200ppm	0 to 5000ppm																	C	H						
	0 to 500ppm	0 to 1%																	E	J						
	0 to 1000ppm	0 to 2%																	F	K						
	0 to 5000ppm	0 to 10%																	H	M						
	0 to 1%	0 to 20%																	J	N						
	0 to 2%	0 to 50%																	K	P						
	0 to 10%	0 to 20%																	M	N						
	0 to 10%	0 to 100%																	M	R						
19	<O <sub>2</sub> analyzer, 1st range>																									
20	Minimum range	Maximum range																								
	None	None																	Y	Y						
	0 to 5%	0 to 25%																	L	V						
	0 to 10%	0 to 25%																	M	V						
	Other																		Z	Z						
21	<Output> 4 to 20mA DC 0 to 1V DC 4 to 20mA DC + Communication function 0 to 1V DC + Communication function																						A	B	C	D
22	<O <sub>2</sub> conversion and O <sub>2</sub> average value output> None With O <sub>2</sub> conversion output With peak alarm With O <sub>2</sub> conversion output and peak alarm	note 6 note 7																					Y	A	B	C
23	<Adjustment, Range designation> For combustion exhaust gas (specified range) For combustion exhaust gas For combustion exhaust gas (specified range) Unit mg/m <sup>3</sup> For combustion exhaust gas, Unit mg/m <sup>3</sup> Others	note 8a) note 8a)b) note 8b) note 9																					B	E	F	G

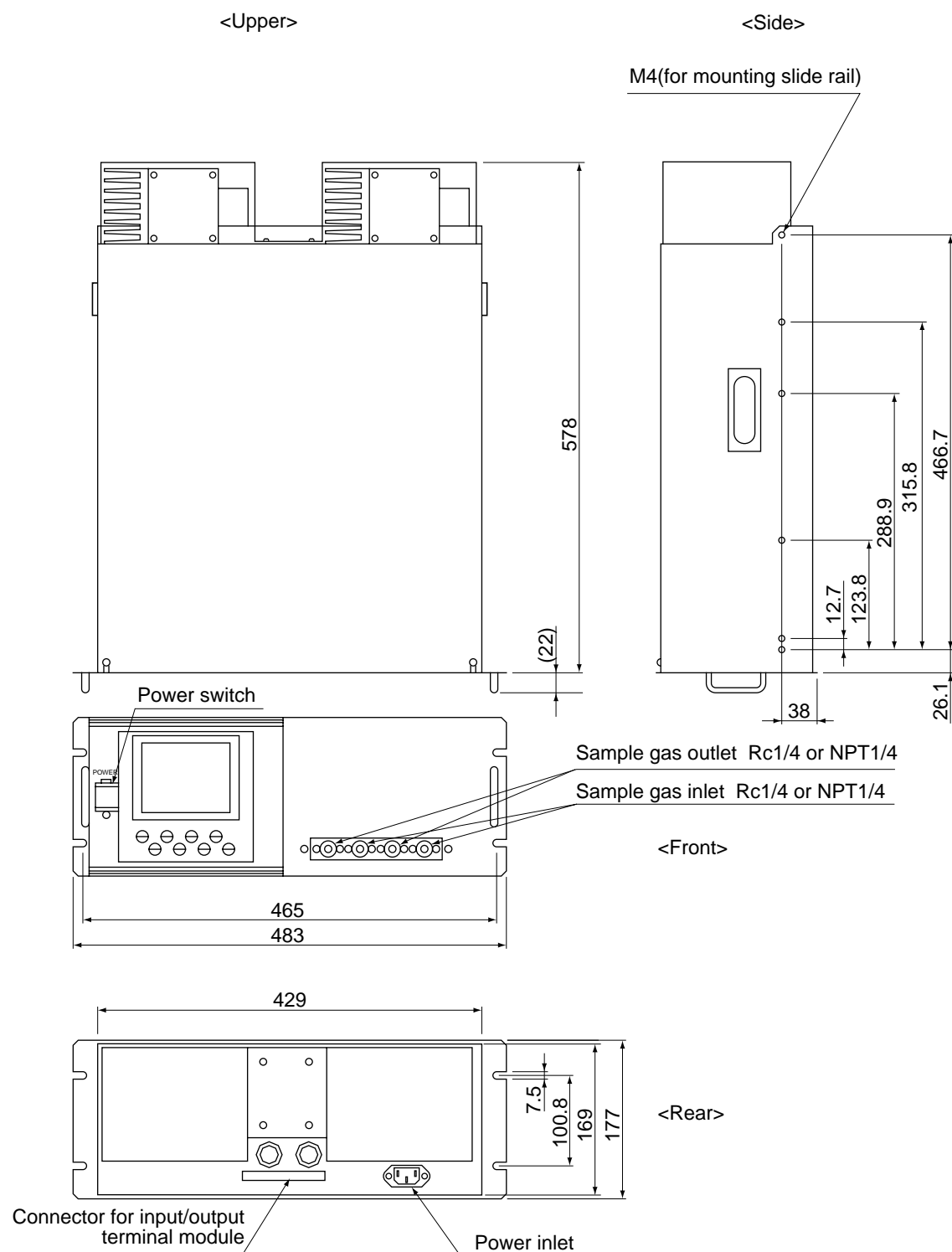
- Note 1** a) When "B" is specified at the 6th digit, O<sub>2</sub> sensor signal has to be set as 0-1V DC linear corresponding to full scale.  
b) External Zirconia O<sub>2</sub> sensor and external O<sub>2</sub> analyzer are not included in the scope of supply, and has to be separately ordered.
- Note 2** a) When "H", "L" and "M" with purging are specified at 5th digit, only one set of gas inlet/outlet is provided.  
In this case, NO<sub>2</sub>/NO converter cannot be mounted in between of two measuring cells.  
b) Resin coupling with purging cannot be manufactured.
- Note 3** Rated voltage and plug type of the attached power cable is different depending on the code "J", "E" and "U" in the 10th digit.  
Select appropriate code according to operation power supply voltage in the final destination.
- Note 4** Measuring range can be selected within either the minimum or maximum range.  
(Within min. or max. range, you can change the actual range settings locally.)  
Initial setting from Fuji factory is Min. range for the 1st range, and Max. range for the 2nd range.  
When range preset at Fuji factory is required, please select "specified range" at 23rd digit and inform Fuji of specified range table.  
Refer to Table 1, for possible combination of measuring components and ranges in the data sheet.
- Note 5** "1E" can be specified at 11th & 12th digits, ONLY for CO<sub>2</sub> measurement.  
In this case, be sure to select "with purging" at 7th digit.
- Note 6** O<sub>2</sub> conversion is calculated only for NO, SO<sub>2</sub> and CO.  
Both average value output after O<sub>2</sub> calculation and O<sub>2</sub> average value output are provided at the same time.  
a) Peak count alarm can be added only for CO measurement.
- Note 7** When "Y" is specified at the 6th digit, 22nd digit always has to be specified as "Y".
- Note 8** a) If you would like Fuji to deliver ZKJ analyzer with specific range setting, select "specified range" and separately inform Fuji of the actual range of each component together with your purchase order.  
b) In case that the measurement unit is specified as "mg/m<sup>3</sup>", it is necessary to select "unit : mg/m<sup>3</sup>" (Code "F" or "G") at the 23rd digit.  
Please refer to the table shown below for the corresponding range code based on "mg/m<sup>3</sup>".

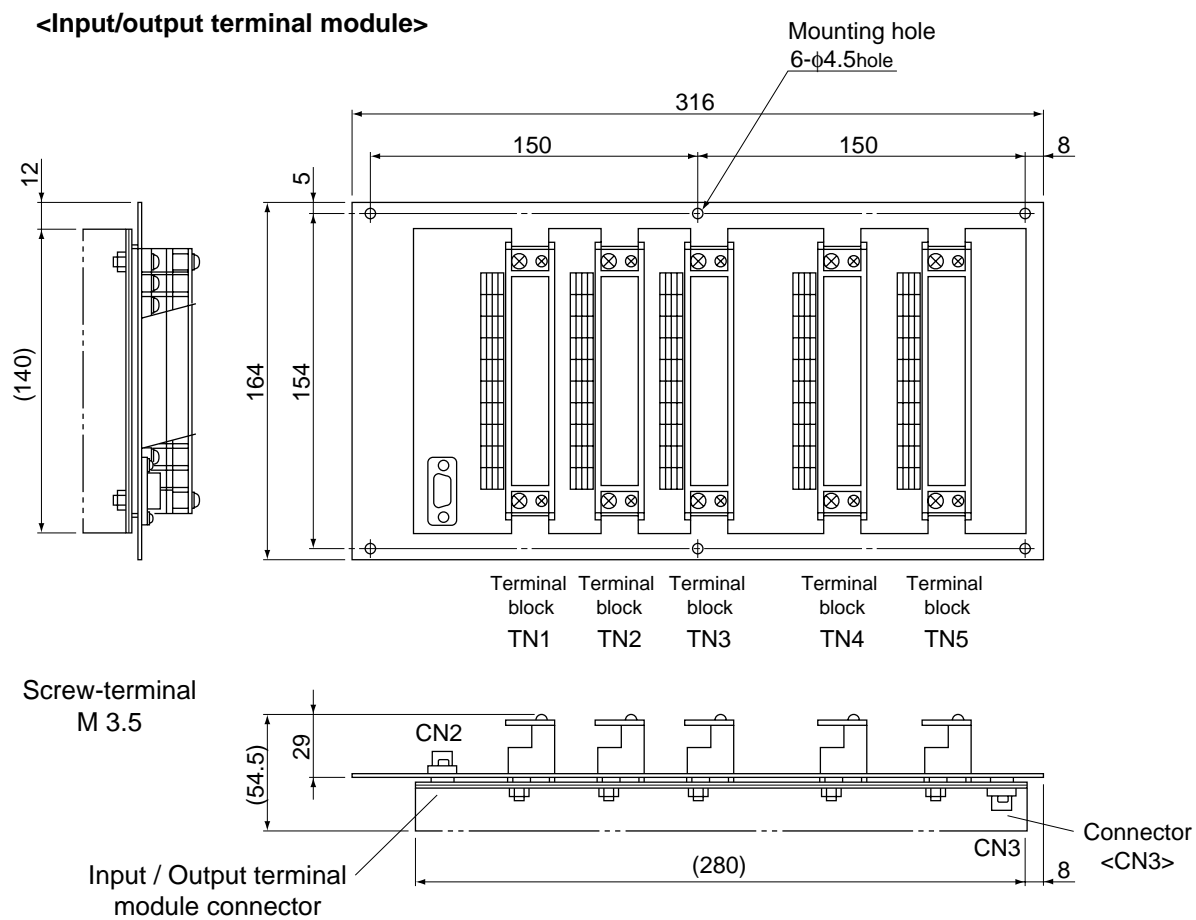
		Corresponding range in mg/m <sup>3</sup> or g/m <sup>3</sup>							
		In ppm		NO		SO <sub>2</sub>		CO	
Range code	Min. range	Max. range	Min. range	Max. range	Min. range	Max. range	Min. range	Max. range	
AF	0-50ppm	0-1000ppm	0-70mg/m <sup>3</sup>	0-1300mg/m <sup>3</sup>	0-150mg/m <sup>3</sup>	0-2800mg/m <sup>3</sup>	0-65mg/m <sup>3</sup>	0-1250mg/m <sup>3</sup>	
BG	0-100ppm	0-2000ppm	0-140mg/m <sup>3</sup>	0-2600mg/m <sup>3</sup>	0-300mg/m <sup>3</sup>	0-5500mg/m <sup>3</sup>	0-130mg/m <sup>3</sup>	0-2500mg/m <sup>3</sup>	
CH	0-200ppm	0-5000ppm	0-280mg/m <sup>3</sup>	0-6600mg/m <sup>3</sup>	0-600mg/m <sup>3</sup>	0-14g/m <sup>3</sup>	0-250mg/m <sup>3</sup>	0-6250mg/m <sup>3</sup>	

- Note 9** When "Z" is specified at the 23rd digit, a gas composition table of actual measured gas has to be sent to Fuji together with your purchase order.
- Note 10** When only N<sub>2</sub>O analyzer is used, make sure not to contain any components other than N<sub>2</sub>O.  
Multicomponent analyzers including N<sub>2</sub>O analyzer + CO<sub>2</sub> analyzer are used for sludge incineration.  
In this case, the range of N<sub>2</sub>O is 0 to 200ppm/500ppm, and the range of CO<sub>2</sub> is 0 to 10%/20%.

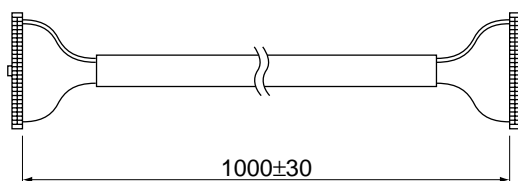
## 9.3 Outline diagram

### <Analyzer main unit>





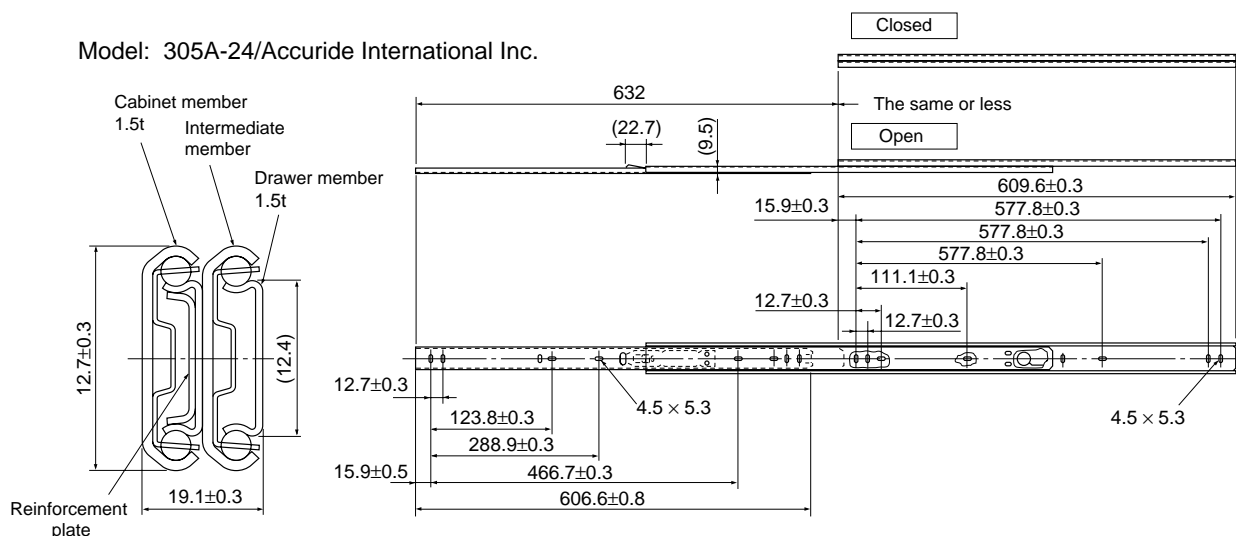
**<Cable for connecting input /output terminal>**



## Outline diagram of accessory slide rail (unit: mm)

\* The slide rails are attached to this equipment when designated.

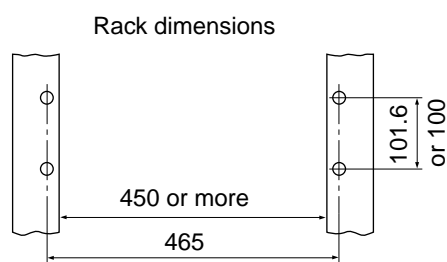
Model: 305A-24/Accuride International Inc.



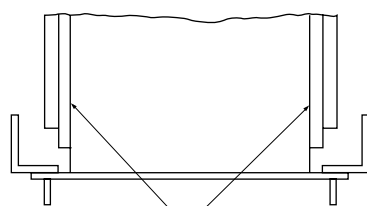
## 19 inch rack mounting method:

The instrument weight should be supported at the base (at the sides in case of slide rail method). For easy maintenance, it is recommended to select the method to allow withdrawing along the slide rail.

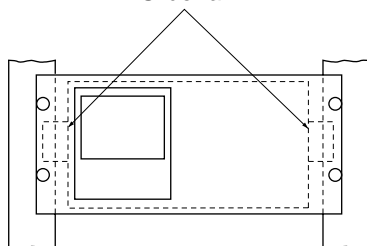
Slide rail mounting method



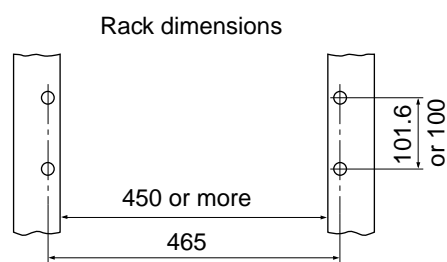
Mounting dimensions



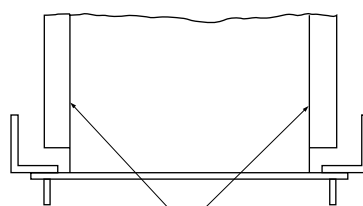
Slide rail



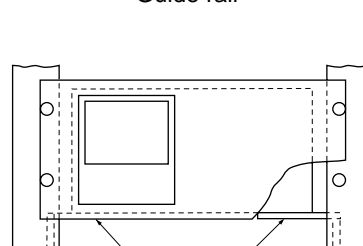
Guide rail mounting method



Mounting dimensions



Guide rail



Guide rail

In selecting the guide rail mounting method, provide a maintenance space (200 mm or more) at top of the rack.

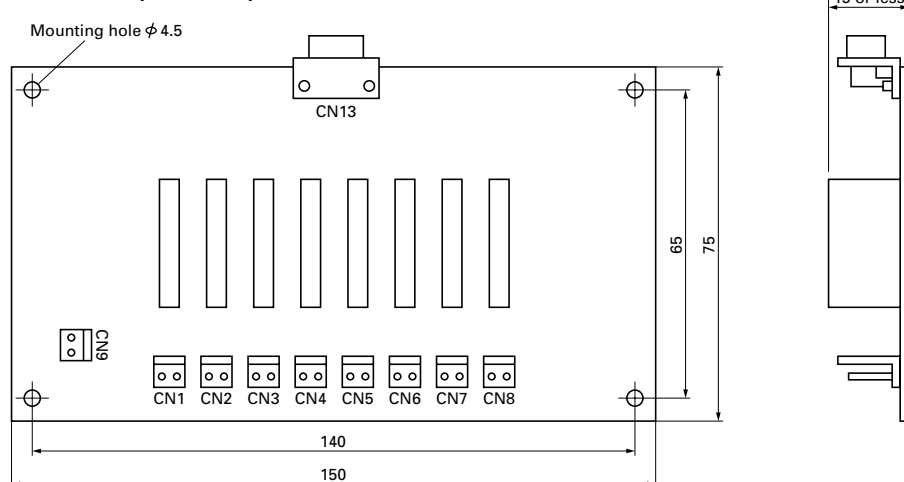


### <<Exclusive relay board>

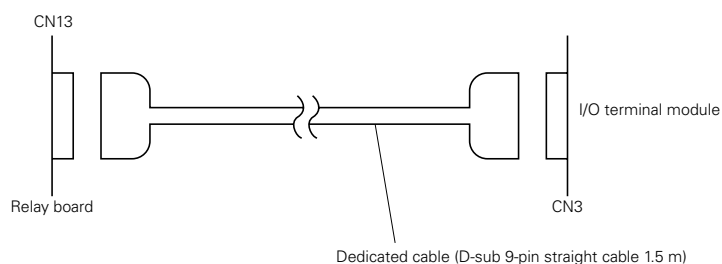
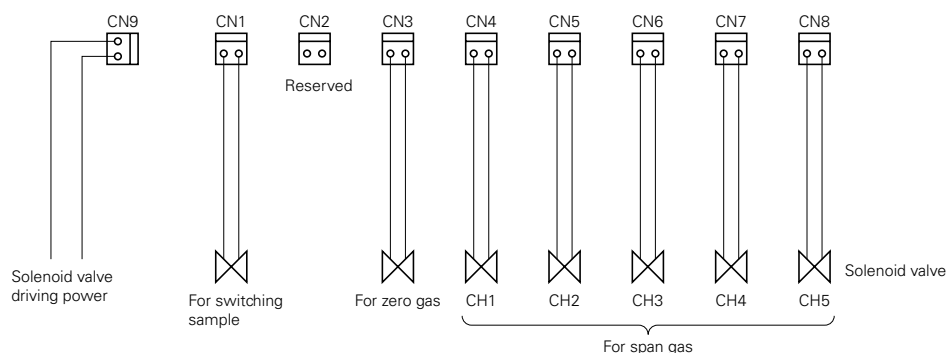
The relay board is used for receiving signals from connector CN3 of the ZKJ input/output terminal module and directly driving the solenoid valve for calibration.

- Relay contact : 1a contact  
Contact capacity: 250V/2A AC (Resistance load)

### OUTLINE DIAGRAM (Unit: mm)



### CONNECTIONS



### Contact operation

- At the time of measurement:  
CN1 ON  
Other OFF
- At the time of calibration:  
CN1 OFF  
Other Contacts corresponding to the timing of each calibration are ON.

### Recommended connector

- CN1 to CN8:  
Housing; VHR-2N (J.S.T. Mfg. Co., Ltd.)  
Contact; SVH-21T-1.1 (J.S.T. Mfg. Co., Ltd.)

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## **Fuji Electric Co., Ltd.**

**Global Sales Section**

**Instrumentation & Sensors Planning Dept.**

1, Fuji-machi, Hino-city, Tokyo 191-8502, Japan

<http://www.fujielectric.com>

Phone: +81-42-514-8930 Fax: +81-42-583-8275

<http://www.fujielectric.com/products/instruments/>

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## Instruction Manual

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# INFRARED GAS ANALYZER COMMUNICATION FUNCTIONS (MODBUS)

TYPE: ZRJ / ZKJ

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# 1. COMMUNICATION FUNCTIONS

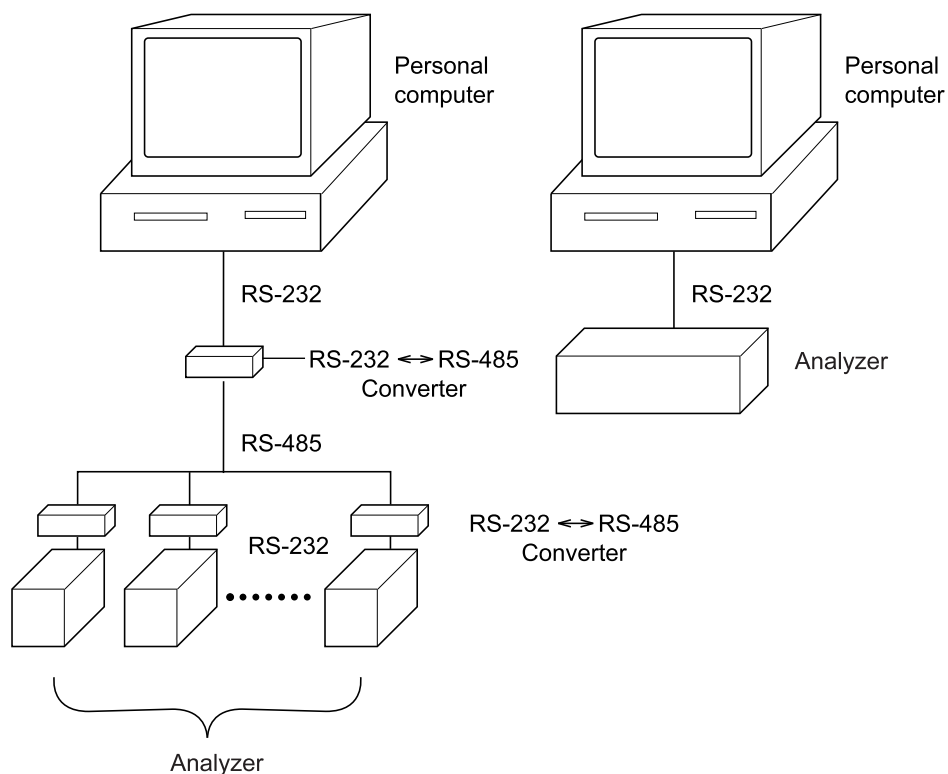
## 1.1 General

- This instrument provides a communication function through RS-232 interface, which allows data transmit to or receive from the host computer and other devices.
- The communication system is comprised of a master station and slave stations. One slave station (this instrument) can be connected to one master station.  
It is also possible to adapt the instrument to the environment of RS-485 interface using RS-232 ↔ RS-485 converter. In this case, up to 31 of slave station (present instrument) can be connected per master station.
- Because the master station can communicate with only one slave station at a time, the destination can be identified by the "Station No" set for each slave station.
- In order that the master station and the slave station can communicate, the format of the transmit/receive data must coincide. In this instrument, the format of the communication data is determined by the MODBUS protocol.

[RS-232 ↔ RS-485 converter] (recommended article)

Type: KS-485 (non-isolated type)/SYSTEM SACOM Corp.

Type: SI-30A (isolated type)/SEKISUI ELECTRONICS Co., Ltd.



## 2. SPECIFICATIONS

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### 2.1 Communication specifications

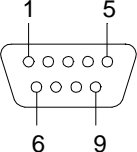
Item	Specification	
Electrical specification	Based on EIA RS-232-C	
Transmission system	2-wire, semi-duplicate	
Synchronizing system	Start-stop synchronous system	
Connection format	1 : 1	
Number connectable units	1 unit (or 31 if RS-485 interface is used)	
Transmission speed	9600bps	
Data format	Data length	8 bits
	Stop bit	1 bit
	Parity	None
	X flow control	None
Transmission code	HEX value (MODBUS RTU mode)	
Error detection	CRC-16	
Isolation	No isolation between transmission circuit and others	

### 3. CONNECTION

#### WARNING

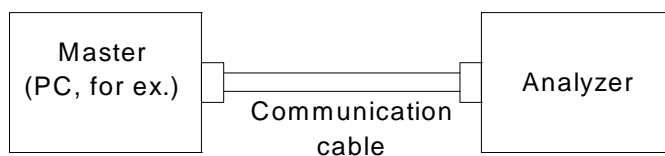
For avoiding electric shock and malfunctions, do not turn on the power supply until all wiring have been completed.

#### 3.1 Terminal allocation (Input/output terminal CN2)

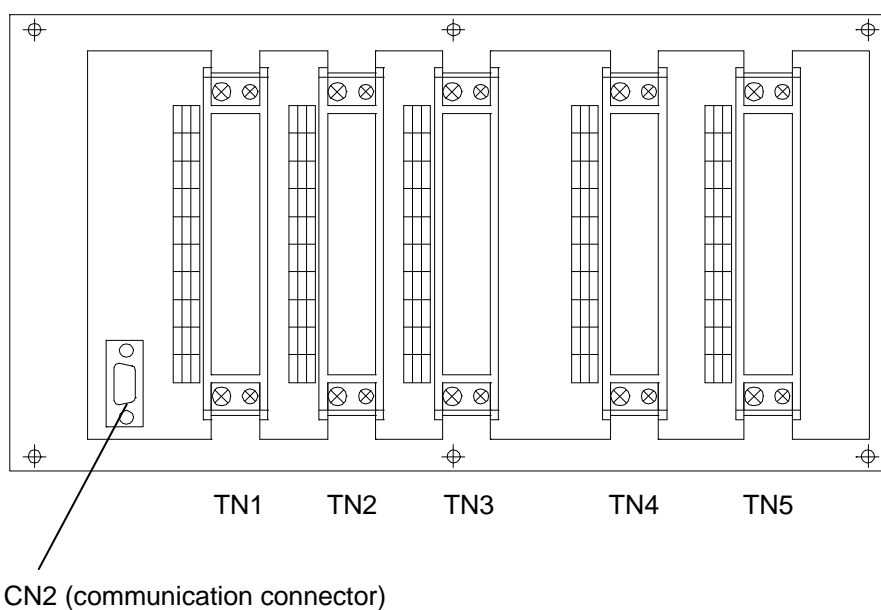
Terminal number	Signal name	Pin connection
2	Recive Data	 9-pin D-Sub (male)
3	Transmit Data	
5	Signal GND	
Others	NC	

#### 3.2 Connection

As connecting cable, use a commercially available RS-232 reverse cable.



Connect the cable to CN2 on the input/output terminal block (on rear for ZRJ, separate for ZKJ).



## 4. SETTING OF COMMUNICATION CONDITION

---

In order that the master station and instrument can correctly communicate, following settings are required.

- All communication condition settings of the master station are the same as those of instruments.
- All instruments connected on a line are set to "Station Nos. (STno)" which are different from each other. (Any "Station No." is not shared by more than one instrument.)

### 4.1 Set items

The parameters to be set are shown in the following table. Set them by operating the front panel keys.

Item	Value at delivery	Setting range	Remarks
Transmission speed	9600bps	Fixed (can not be changed)	Set the same communication condition to the master station and all slave stations.
Data length	8 bits	Fixed (can not be changed)	
Stop bit	1 bit	Fixed (can not be changed)	
Parity setting	None	Fixed (can not be changed)	
Station No.	1	0 to 31 (0:communication function stop)	Set a different value to each station.

### 4.2 Setting operation

Set the station No. on the analyzer maintenance mode display (see the instruction manual).



## 5. MODBUS COMMUNICATION PROTOCOL

---

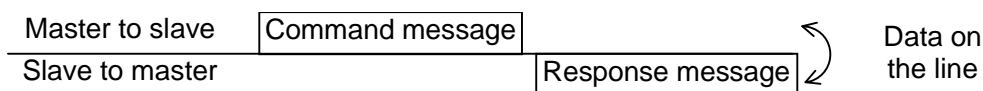
### 5.1 General

The communication system by the MODBUS protocol is that the communication is always started from the master station and a slave station responds to the received message.

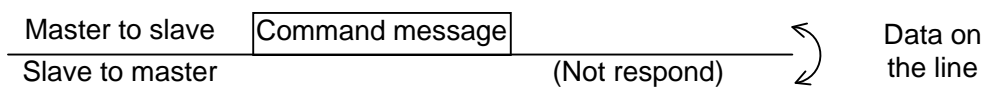
Transmission procedures is as shown below.

- 1) The master station sends a command message to a slave station.
- 2) The slave station checks that the station No. in the received message matches with the own station No. or not.
- 3) If matched, the slave station executes the command and sends back the response message.
- 4) If mismatched, the slave station leaves the command message and wait for the next command message.

- a) In case when the station No. in the received command message matches with the own slave station No.



- b) In case when the station No. in the received command message mismatches with the own slave station No.



The master station can individually communicate with any one of slave stations connected on the same line upon setting the station No. in the command message.

---

## 5.2 Composition of message

Command message and response message consist of 4 fields ; Station No., Function code, Data and Error check code. And these are send in this order.

Station No. (1 byte)
Function code (1 byte)
Data (2 to 133 bytes)
Error check code (CRC-16) (2 bytes)

**Fig. 5-1 Composition of message**

In the following, each field is explained.

### (1) Station No.

Station No. is the number specifying a slave station. Only a slave station that corresponds to a value to which "Station No." is set on the analyzer maintenance mode display executes a command.

### (2) Function code

This is a code to designate the function executed at a slave station.  
For details, refer to section 5.4.

### (3) Data

Data are the data required for executing function codes. The composition of data varies with function codes. For details, refer to chapter 6.

A register number is assigned to each data in the analyzer. For reading/writing the data by communication, designate the register number.

Note that the register number transmitted on message is expressed as its relative address.  
The relative address is calculated by the following expression.

$$\boxed{\text{Relative address}} = \left( \text{The lower 4 digits of the } \boxed{\text{Register number}} \right) - 1$$

For example, when the resister number designated by a function code is 40003,

$$\begin{aligned} \text{Relative address} &= (\text{lower 4 digits of 40003}) - 1 \\ &= 0002 \end{aligned}$$

is used on the message.

---

#### **(4) Error check code**

This is the code to detect message errors (change in bit) in the signal transmission.

On the MODBUS protocol (RTU mode), CRC-16 (Cyclic Redundancy Check) is applied.

For CRC calculation method, refer to section 5.5.

---

## 5.3 Response of slave station

### (1) Response for normal command

To a relevant message, the slave station creates and sends back a response message which corresponds to the command message. The composition of message in this case is the same as in section 5.2.

Contents of the data field depend on the function code. For details, refer to Chapter 6.

### (2) Response for abnormal command

If contents of a command message have an abnormality (for example, non-actual function code is designated) other than transmission error, the slave station does not execute that command but creates and sends back a response message at error detection.

The composition of response message at error detection is as shown in Fig. 5-2. The value used for function code field is function code of command message plus 80<sub>H</sub>.

Table 5-1 gives error codes.

Station No.
Function code + 80 <sub>H</sub>
Error code
Error check (CRC-16)

**Fig. 5-2 Response message at error detection**

**Table 5-1 Error code**

Error code	Contents	Description
01H	Illegal function	Non-actual function code is designated. Check for the function code.
02H	Illegal data address	A relative address of a register number to which the designated function code can not be used.
03H	Illegal data value	Because the designation of number is too much, the area where register numbers do not exist is designated.

### (3) No response

Under any of the following items, the slave station takes no action of the command message and sends back no response.

- A station number transmitted in the command message differs from the station number specified to the slave station.
- A error check code is not matched, or a transmission error (parity error, etc.) is detected.
- The time interval between the composition data of the message becomes longer than the time corresponding to 24 bits. (Refer to section 5.6 Transmission control procedure)

## 5.4 Function code

According to MODBUS protocol, register numbers are assigned by function codes.

Each function code acts on specific register number.

This correspondence is shown in Table 5-2, and the message length by function is shown in Table 5-3.

**Table 5-2 Correspondence between function codes and objective address**

Function code			↔	Resister No.	
No.	Function	Object		No.	Contents
03 <sub>H</sub>	Read-out (continuously)	Holding register		4xxxx	Read-out/write-in word data
04 <sub>H</sub>	Read-out (continuously)	Input register		3xxxx	Read-out word data
06 <sub>H</sub>	Write-in	Holding register		4xxxx	Read-out/write-in word data
10 <sub>H</sub>	Write-in (continuously)	Holding register		4xxxx	Read-out/write-in word data

**Table 5-3 Function code and message length**

[Unit : byte]

Function code	Contents	Number of designatable data	Command message		Response message	
			Minimum	Maximum	Minimum	Maximum
03 <sub>H</sub>	Read-out of word data	64 words	8	8	7	133
04 <sub>H</sub>	Read-out of word data (read-out only)	64 words	8	8	7	133
06 <sub>H</sub>	Write-in of word data	1 word	8	8	8	8
10 <sub>H</sub>	Write-in of continuous word data	64 words	11	137	8	8

## 5.5 Calculation of error check code (CRC-16)

CRC-16 is the 2-byte (16-bits) error check code. From the top of the message (station No.) to the end of the data field are calculated.

The slave station calculates the CRC of the received message, and does not respond if the calculated CRC is different from the contents of the received CRC code.

The following shows the calculation procedure for CRC-16.

- (a) Store  $\text{FFFF}_H$  into 16 bit register (CRC register).
- (b) Subject the 1st byte (8 bits) of transmit message and CRC register contents to an exclusive logical summation (XOR), and store the result into the CRC register.
- (c) Shift the CRC register contents 1 bit to the right. Store 0 at MSB.
- (d) If LSB before shifting is 0, do nothing.  
If LSB before shifting is 1, subject it and  $\text{A001}_H$  to XOR, and store the result into the CRC register.
- (e) Repeat the steps (c) and (d) 8 times (shift by 8 bits).
- (f) Execute steps (b) to (e) for the next byte of the transmit message.  
Likewise, successively repeat the steps to each byte of the transmit message.
- (g) The CRC code that is retained is the value of CRC register that stands when the processing has ended for latest byte (latest data except error code) of the transmit message.
- (h) As error check code of the transmit message, store this CRC value in the order of lower 8 bits and upper 8 bits.

Transmit message (ex.)

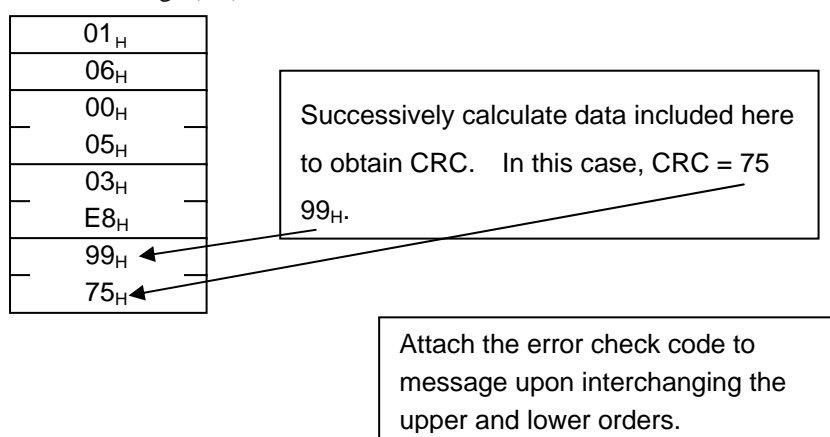
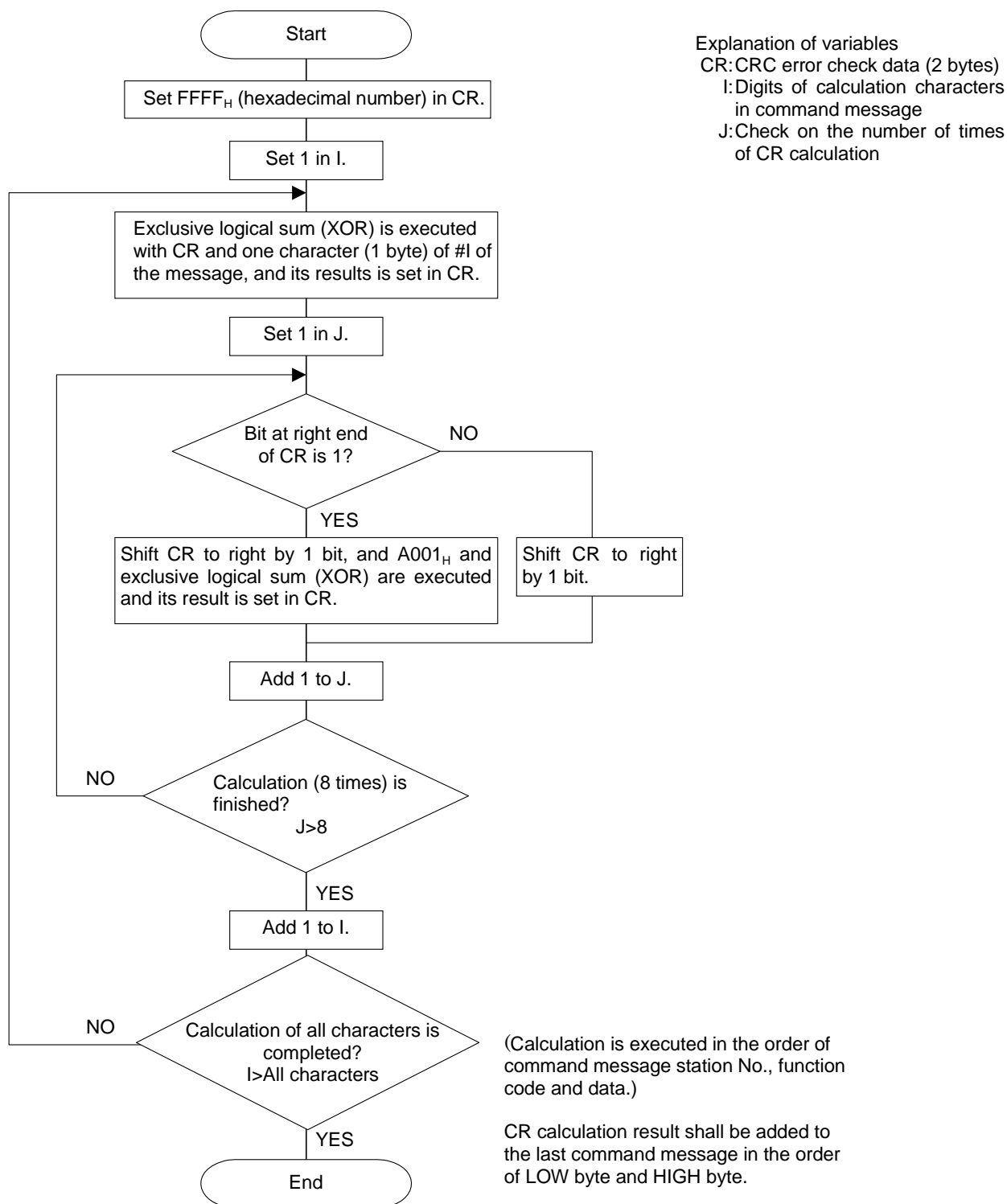


Fig. 5-3 shows the flow of the CRC-16 calculation system.



**Fig. 5-3 Flow of CRC-16 calculation**

---

## 5.6 Transmission control procedure

### (1) Transmission procedure of master station

The master station must proceed to a communication upon conforming to the following items.

- (1-1) Before sending a command message, provide 48 bits time or more vacant status.
- (1-2) For sending, the interval between bytes of a command message is below 24 bits time.
- (1-3) Within 24 bits time after sending a command message, the receiving status is posted.
- (1-4) Provide 48 bits time or more vacant status between the end of response message reception and beginning of next command message sending [same as in (1-1)].
- (1-5) For ensuring the safety, make a confirmation of the response message and make an arrangement so as to provide 3 times or more retries in case of no response, error occurrence, etc.

Note) The above definition is for most unfavorable value. For ensuring the safety, it's recommended the program of the master to work with safety factors of 2 to 3. Concretely, it is advised to arrange the program for 9600 bps with 10 ms or more for vacant status (1-1), and within 1 ms for byte interval (1-2) and changeover from sending to receiving (1-3).

### (2) Description

#### 1) Detection of the message frame

The status on the line of the communication system is one of the 2 below.

- (a) Vacant status (no data on line)
- (b) Communication status (data is existing)

Instruments connected on the line are initially at a receiving status and monitoring the line. When 24 bits time or more vacant status has appeared on the line, the end of preceding frame is assumed and, within following 24 bits time, a receiving status is posted. When data appears on the line, instruments receive it while 24 bits time or more vacant status is detected again, and the end of that frame is assumed. I.e., data which appeared on the line from the first 24 bits time or more vacant status to the next 24 bits time or more vacant status is fetched as one frame.

Therefore, one frame (command message) must be sent upon confirming the following.

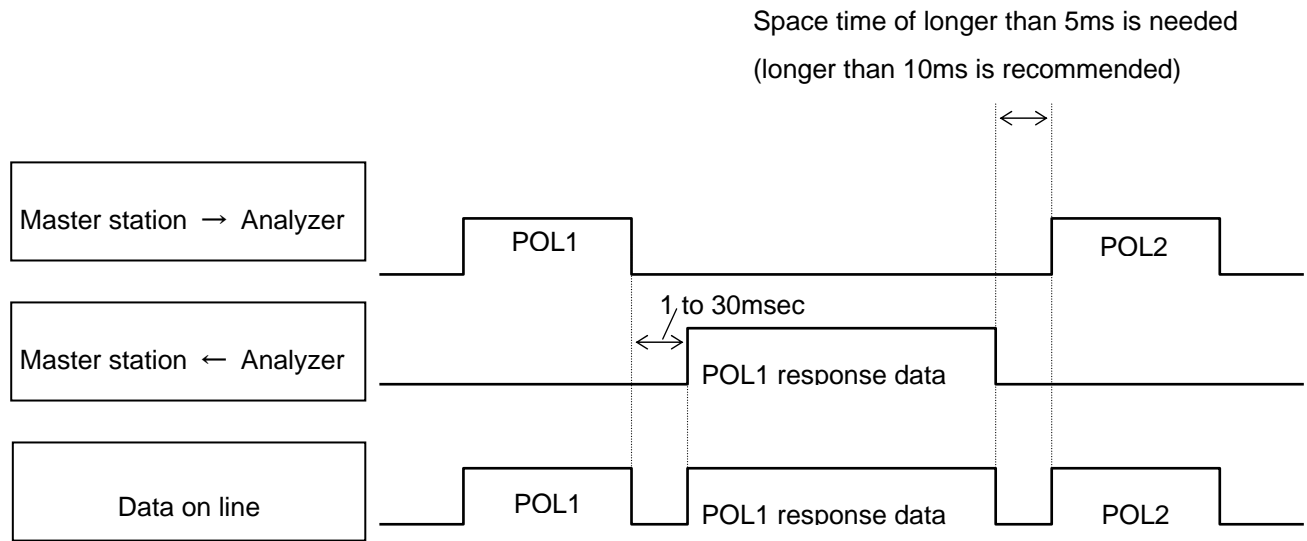
- (1-1) 48 bits time or more vacant status precedes before the command message sending.
- (1-2) Interval between bytes of 1 command message is smaller than 24 bits time.

#### 2) Response of this instrument

After a frame detection (24 bits time or more vacant status), this instrument carries out processing with that frame as a command message. If the command message is destined to the own station, a response message is returned. Its processing time is 1 to 30 ms (depends on contents of command message). After sending a command message, therefore, the master station must observe the following.

- (1-3) Receiving status is posted within 24 bits time after sending a command message.





## 6. DETAILS OF MESSAGE

### 6.1 Read-out of word data [Function code:03<sub>H</sub>]

Function code	Max. word number read-out in one message	Relative data address	Resister No.	Contents
03 <sub>H</sub>	64 words	0000 <sub>H</sub> —006D <sub>H</sub>	40001—40110	User setting

#### (1) Message composition

Command message composition (byte)

Station No.	
Function code	
Read-out start No. (relative address)	Upper
	Lower
Read-out word number	Upper
	Lower
CRC data	Lower
	Upper

} 1 to 64

Response message composition (byte)

Station No.	
Function code	
Read-out byte number	
Contents of the first word data	Upper
	Lower
Contents of the next word data	Upper
	Lower
Contents of the last word data	Upper
	Lower
CRC data	Lower
	Upper

Read-out word number × 2

\* Arrangement of read-out word data

MSB	LSB
Upper byte of contents of the first word data	
Lower byte of contents of the first word data	
Upper byte of contents of the next word data	
Lower byte of contents of the next word data	
Upper byte of contents of the last word data	
Lower byte of contents of the last word data	

#### (2) Function explanations

Word data of continuous word numbers from the read-out start No. can be read. Read-out word data are transmitted from the slave station in the order of upper and lower bytes.

---

### (3) Message transmission (example)

The following shows an example of reading out from No. 1 station the setting CH2 (2nd component) range-1 zero and span calibration concentration.

Relative address of CH2 range-1 zero calibration concentration setting: 0004<sub>H</sub>      Data number: 02<sub>H</sub>

Command message composition (byte)

Station No.	01 <sub>H</sub>	
Function code	03 <sub>H</sub>	
Read-out start No. (relative address)	Upper	00 <sub>H</sub>
	Lower	04 <sub>H</sub>
Read-out word number	Upper	00 <sub>H</sub>
	Lower	02 <sub>H</sub>
CRC data	Lower	85 <sub>H</sub>
	Upper	CA <sub>H</sub>

Response message composition (byte)

Station No.	01 <sub>H</sub>	
Function code	03 <sub>H</sub>	
Read-out byte number	04 <sub>H</sub>	
Contents of the first word data	Upper	00 <sub>H</sub>
	Lower	00 <sub>H</sub>
Contents of the next word data	Upper	03 <sub>H</sub>
	Lower	E8 <sub>H</sub>
CRC data	Lower	FA <sub>H</sub>
	Upper	8D <sub>H</sub>

\* Meaning of read-out data

CH2 range-1 zero calibration concentration setting    00 00<sub>H</sub> = 0  
(contents of first word data)

CH2 range-1 span calibration concentration setting    03 E8<sub>H</sub> = 1000  
(contents of next word data)

Provided decimal point position = 1, measurement unit = 1,

CH2 range-1 zero calibration concentration = 0.0 ppm

CH2 range-1 span calibration concentration = 100.0 ppm



For handling of decimal point and unit, refer to Section 7.1.

## 6.2 Read-out of read only word data [Function code:04<sub>H</sub>]

Function code	Max. word number read-out in one message	Relative data address	Resister No.	Contents
04 <sub>H</sub>	64 words	0000 <sub>H</sub> —00BD <sub>H</sub>	30001—30190	Measurement value and status
		0425 <sub>H</sub> —0447 <sub>H</sub>	31062—31096	Fixed setting

### (1) Message composition

Command message composition (byte)

Station No.	
Function code	
Read-out start No. (relative address)	Upper
	Lower
Read-out word number	Upper
	Lower
CRC data	Lower
	Upper

Response message composition (byte)

Station No.	
Function code	
Read-out byte number	
Contents of the first word data	Upper
	Lower
Contents of the next word data	Upper
	Lower
—	
Contents of the last word data	Upper
	Lower
CRC data	Lower
	Upper

Read-out word number × 2

\* Arrangement of read-out word data

MSB	LSB
Upper byte of contents of the first word data	
Lower byte of contents of the first word data	
Upper byte of contents of the next word data	
Lower byte of contents of the next word data	
—	
Upper byte of contents of the last word data	
Lower byte of contents of the last word data	

### (2) Function explanations

Word data of continuous word numbers from the read-out start No. can be read. Read-out word data are transmitted from the slave station in the order of upper and lower bytes.

---

### (3) Message transmission (example)

The following shows an example of reading out from No. 1 station the CH5 measurement concentration, decimal point position and measurement unit.

Relative address of CH5 measurement concentration: 000C<sub>H</sub>    Data number: 03<sub>H</sub>

Command message composition (byte)

Station No.		01 <sub>H</sub>
Function code		04 <sub>H</sub>
Read-out start No. (relative address)	Upper	00 <sub>H</sub>
	Lower	0C <sub>H</sub>
Read-out word number	Upper	00 <sub>H</sub>
	Lower	03 <sub>H</sub>
CRC data	Lower	70 <sub>H</sub>
	Upper	08 <sub>H</sub>

Response message composition (byte)

Station No.		01 <sub>H</sub>
Function code		04 <sub>H</sub>
Read-out byte number		06 <sub>H</sub>
Contents of the first word data	Upper	04 <sub>H</sub>
	Lower	B0 <sub>H</sub>
Next word data contents	Upper	00 <sub>H</sub>
	Lower	02 <sub>H</sub>
Latest word data contents	Upper	00 <sub>H</sub>
	Lower	00 <sub>H</sub>
CRC data	Lower	81 <sub>H</sub>
	Upper	0D <sub>H</sub>

\* Meaning of read-out data

First word data contents	04	B0 <sub>H</sub> = 1200
Next word data contents	00	02 <sub>H</sub> = 2 (decimal point position)
Latest word data contents	00	00 <sub>H</sub> = 0 (vol %)

In the above case, measurement concentration = 12.00 vol%



For handling of decimal point and unit, refer to Section 7.1.

## 6.3 Write-in of word data (1 word) [Function code:06<sub>H</sub>]

Function code	Max. word number write-in in one message	Relative data address	Resister No.	Contents
06 <sub>H</sub>	1 word	0000 <sub>H</sub> —006D <sub>H</sub>	40001—40110	User setting
		07D0 <sub>H</sub> —07D1 <sub>H</sub>	42001—42002	Operation command

### (1) Message composition

Command message composition (byte)

Station No.	
Function code	
Write-in designate No. (relative address)	Upper
	Lower
Write-in word data	Upper
	Lower
CRC data	Lower
	Upper

Response message composition (byte)

Station No.	
Function code	
Write-in designate No. (relative address)	Upper
	Lower
Write-in word data	Upper
	Lower
CRC data	Lower
	Upper

### (2) Function explanation

Designated word data is written in write-in designate No. Write-in data are transmitted from master station in the order of upper and lower bytes.

### (3) Message transmission (example)

The following shows an example of transmitting the "ZERO" key command to No. 1 station.

Key operation command Relative address: 07D0<sub>H</sub>

Command message composition (byte)

Station No.		01 <sub>H</sub>
Function code		06 <sub>H</sub>
Write-in designate No. (relative address)	Upper	07 <sub>H</sub>
	Lower	D0 <sub>H</sub>
Write-in word data	Upper	00 <sub>H</sub>
	Lower	40 <sub>H</sub>
CRC data	Lower	88 <sub>H</sub>
	Upper	B7 <sub>H</sub>

} ZERO key command

Response message composition (byte)

Station No.		01 <sub>H</sub>
Function code		06 <sub>H</sub>
Write-in designate No. (relative address)	Upper	07 <sub>H</sub>
	Lower	D0 <sub>H</sub>
Write-in word data	Upper	00 <sub>H</sub>
	Lower	40 <sub>H</sub>
CRC data	Lower	88 <sub>H</sub>
	Upper	B7 <sub>H</sub>

## 6.4 Write-in of continuous word data [Function code:10<sub>H</sub>]

Function code	Max. word number write-in in one message	Relative data address	Resister No.	Kind of data
10 <sub>H</sub>	64 words	0000 <sub>H</sub> —006D <sub>H</sub>	40001—40110	User setting

### (1) Message composition

Command message composition (byte)

Station No.	
Function code	
Write-in start No. (relative address)	Upper
	Lower
Write-in word number	Upper
	Lower
Write-in byte number	
First write-in word data	Upper
	Lower
Next write-in word data	Upper
	Lower
Last write-in word data	Upper
	Lower
CRC data	Lower
	Upper

} 1 to 64  
 } Write-in word number × 2

Response message composition (byte)

Station No.	
Function code	
Write-in start No. (relative address)	Upper
	Lower
Write-in word number	Upper
	Lower
CRC data	Lower
	Upper

\* Arrangement of write-in word data

MSB LSB

Upper byte of contents of the first word data
Lower byte of contents of the first word data
Upper byte of contents of the next word data
Lower byte of contents of the next word data
Upper byte of contents of the last word data
Lower byte of contents of the last word data

### (2) Function explanation

Word data of continuous word number is written from write-in start address. Write-in word data are transmitted from master station in the order of upper and lower bytes.

### (3) Message transmission (example)

The following shows an example of writing the CH1 (1st component) alarm settings to No. 1 station.

CH1 range-1 high alarm setting = 1388<sub>H</sub> (= 5000<sub>D</sub>)

CH1 range-1 low alarm setting = 000A<sub>H</sub> (= 10<sub>D</sub>)

CH1 range-2 high alarm setting = 03E8<sub>H</sub> (= 1000<sub>D</sub>)

CH1 range-2 low alarm setting = 000A<sub>H</sub> (= 10<sub>D</sub>)

CH1 range-1 high alarm setting    Relative address: 0023<sub>H</sub>

Data number: 04<sub>H</sub>

Command message composition (byte)

Station No.		01 <sub>H</sub>
Function code		10 <sub>H</sub>
Write-in start No.	Upper	00 <sub>H</sub>
	Lower	23 <sub>H</sub>
Write-in word number	Upper	00 <sub>H</sub>
	Lower	04 <sub>H</sub>
Write-in byte number		08 <sub>H</sub>
First write-in word data	Upper	13 <sub>H</sub>
	Lower	88 <sub>H</sub>
Next write-in word data	Upper	00 <sub>H</sub>
	Lower	0A <sub>H</sub>
Next write-in word data	Upper	03 <sub>H</sub>
	Lower	E8 <sub>H</sub>
Last write-in word data	Upper	00 <sub>H</sub>
	Lower	0A <sub>H</sub>
CRC data	Lower	E2 <sub>H</sub>
	Upper	A6 <sub>H</sub>

Response message composition (byte)

Station No.		01 <sub>H</sub>
Function code		10 <sub>H</sub>
Write-in start No.	Upper	00 <sub>H</sub>
	Lower	23 <sub>H</sub>
Write-in word number	Upper	00 <sub>H</sub>
	Lower	04 <sub>H</sub>
CRC data	Lower	30 <sub>H</sub>
	Upper	00 <sub>H</sub>



Since the transmission data can not include a decimal point, data of 500.0 is transmitted as "5000".

For transmission format of each data, refer to the Address map (Chapter 7).



## 7. ADDRESS MAP AND DATA FORMAT

---

### 7.1 Data format

#### 7.1.1 Transmission data format

The MODBUS protocol used in this instrument is RTU (Remote Terminal Unit) mode.  
Transmitted data is "numeric value" and not ASCII code".

#### 7.1.2 Handling of decimal point position and measurement unit

When transmitted, the calibration concentration setting, alarm's high and low limits and measurement concentration data have no decimal point nor measurement unit.

Calculate exact values of data upon point positioning as shown below.

- (a) Calibration concentration setting (register No. 40001 to 40020)  
Alarm setting (register No. 40036 to 40055)

You can know the point position for each CH (channel) and each range, and unit upon reading in the decimal point position data (register No. 31087 to 31096), and the unit data (register No. 31067 to 31076).

The decimal point position data has a value of 0, 1, 2 or 3. You can obtain an exact value by the following calculation.

- Case 0: Calibration concentration setting data /1
- Case 1: Calibration concentration setting data /10
- Case 2: Calibration concentration setting data /100
- Case 3: Calibration concentration setting data /1000

The unit data has a value of 0, 1, 2 or 3, that corresponds as follows.

- Case 0: vol%
- Case 1: ppm
- Case 2: mg/m<sup>3</sup>
- Case 3: g/m<sup>3</sup>

For example, if:

- CH1 range-1 span calibration concentration setting (register No. 40002) = 2000,
- CH1 range-1 decimal point position (register No. 31087) = 1, and
- CH1 range-1 unit (register No. 31067) = 1,

the value is 200.0 ppm.

For writing-in, proceed in the reverse. To obtain 200.0 ppm, write 2000 as calibration concentration setting.

The decimal point position and unit are unchangeable because fixed to each CH and each range.

---

(b) Measurement concentration (register No. 30001 to 30036)

The decimal point position and measurement unit for each concentration are stored in registers following that of concentration, and can be known by reading them in.

The meaning of decimal point position data and measurement unit data values are the same as in (a) above.

For example, if:

CH3 measurement concentration (register No. 30007) = 1270,

CH3 decimal point position (register No. 30008) = 2,

CH3 measurement unit (register No. 30009) = 0,

the value is 12.70 vol%

### 7.1.3 Handling at measurement data over-range

Even if the measurement data is at over-range, with "— — — —" displayed on the screen, the concentration that stands then is transmitted as read-out measurement concentration.

## 7.2 Address map

For details of functions and settable ranges of different parameters, refer to the instruction manual for the analyzer.

**Word data [read-out/write-in]: Function code [03<sub>H</sub>, 06<sub>H</sub>, 10<sub>H</sub>]**

**User settings**

Relative address	Register No.	Data type	Memory contents	Read-out/write-in data	Remarks or corresponding parameter	Relevant model
0000 <sub>H</sub>	40001	Word	CH1 range-1 zero calibration concentration	0 to 9999  Decimal point position depends on range	Calibration value	R/K
0001 <sub>H</sub>	40002	Word	CH1 range-1 span calibration concentration			R/K
0002 <sub>H</sub>	40003	Word	CH1 range-2 zero calibration concentration			R/K
0003 <sub>H</sub>	40004	Word	CH1 range-2span calibration concentration			R/K
0004 <sub>H</sub>	40005	Word	CH2 range-1 zero calibration concentration			R/K
0005 <sub>H</sub>	40006	Word	CH2 range-1 span calibration concentration			R/K
0006 <sub>H</sub>	40007	Word	CH2 range-2 zero calibration concentration			R/K
0007 <sub>H</sub>	40008	Word	CH2 range-2 span calibration concentration			R/K
0008 <sub>H</sub>	40009	Word	CH3 range-1 zero calibration concentration			R/K
0009 <sub>H</sub>	40010	Word	CH3 range-1 span calibration concentration			R/K
000A <sub>H</sub>	40011	Word	CH3 range-2 zero calibration concentration			R/K
000B <sub>H</sub>	40012	Word	CH3 range-2 span calibration concentration			R/K
000C <sub>H</sub>	40013	Word	CH4 range-1 zero calibration concentration			R/K
000D <sub>H</sub>	40014	Word	CH4 range-1 span calibration concentration			R/K
000E <sub>H</sub>	40015	Word	CH4 range-2 zero calibration concentration			R/K
000F <sub>H</sub>	40016	Word	CH4 range-2 span calibration concentration			R/K
0010 <sub>H</sub>	40017	Word	CH5 range-1 zero calibration concentration			K
0011 <sub>H</sub>	40018	Word	CH5 range-1 span calibration concentration			K
0012 <sub>H</sub>	40019	Word	CH5 range-2 zero calibration concentration			K
0013 <sub>H</sub>	40020	Word	CH5 range-2 span calibration concentration			K

**Word data [read-out/write-in]: Function code [03<sub>H</sub>, 06<sub>H</sub>, 10<sub>H</sub>]**

**User settings**

Relative address	Register No.	Data type	Memory contents	Read-out/write-in data	Remarks or corresponding parameter	Relevant model
0014 <sub>H</sub>	40021	Word	CH1 auto calibration switch	0, 1 (0: Do not calibrate in auto calibration 1: Calibrate in auto calibration)	Auto calibration component	R/K
0015 <sub>H</sub>	40022	Word	CH2 auto calibration switch			R/K
0016 <sub>H</sub>	40023	Word	CH3 auto calibration switch			R/K
0017 <sub>H</sub>	40024	Word	CH4 auto calibration switch			R/K
0018 <sub>H</sub>	40025	Word	CH5 auto calibration switch			K
0019 <sub>H</sub>	40026	Word	CH1 zero calibration switch	0,1 (0: Selectable zero calibration, 1: Zero calibration at once)	About zero calibration	R/K
001A <sub>H</sub>	40027	Word	CH2 zero calibration switch			R/K
001B <sub>H</sub>	40028	Word	CH3 zero calibration switch			R/K
001C <sub>H</sub>	40029	Word	CH4 zero calibration switch			R/K
001D <sub>H</sub>	40030	Word	CH5 zero calibration switch			K
001E <sub>H</sub>	40031	Word	CH1 calibration range switch	0,1 (0: Calibrate indicated range only, 1: Calibrate both ranges at same time)	About calibration range	R/K
001F <sub>H</sub>	40032	Word	CH2 calibration range switch			R/K
0020 <sub>H</sub>	40033	Word	CH3 calibration range switch			R/K
0021 <sub>H</sub>	40034	Word	CH4 calibration range switch			R/K
0022 <sub>H</sub>	40035	Word	CH5 calibration range switch			K
0023 <sub>H</sub>	40036	Word	CH1 range-1 high alarm setting	0 to 9999 Decimal point position depends on range	Alarm setting	R/K
0024 <sub>H</sub>	40037	Word	CH1 range-1 low alarm setting			R/K
0025 <sub>H</sub>	40038	Word	CH1 range-2 high alarm setting			R/K
0026 <sub>H</sub>	40039	Word	CH1 range-2 low alarm setting			R/K
0027 <sub>H</sub>	40040	Word	CH2 range-1 high alarm setting			R/K
0028 <sub>H</sub>	40041	Word	CH2 range-1 low alarm setting			R/K
0029 <sub>H</sub>	40042	Word	CH2 range-2 high alarm setting			R/K
002A <sub>H</sub>	40043	Word	CH2 range-2 low alarm setting			R/K
002B <sub>H</sub>	40044	Word	CH3 range-1 high alarm setting			R/K
002C <sub>H</sub>	40045	Word	CH3 range-1 low alarm setting			R/K
002D <sub>H</sub>	40046	Word	CH3 range-2 high alarm setting			R/K
002E <sub>H</sub>	40047	Word	CH3 range-2 low alarm setting			R/K
002F <sub>H</sub>	40048	Word	CH4 range-1 high alarm setting			R/K
0030 <sub>H</sub>	40049	Word	CH4 range-1 low alarm setting			R/K
0031 <sub>H</sub>	40050	Word	CH4 range-2 high alarm setting			R/K
0032 <sub>H</sub>	40051	Word	CH4 range-2 low alarm setting			R/K
0033 <sub>H</sub>	40052	Word	CH5 range-1 high alarm setting			K
0034 <sub>H</sub>	40053	Word	CH5 range-1 low alarm setting			K
0035 <sub>H</sub>	40054	Word	CH5 range-2 high alarm setting			K
0036 <sub>H</sub>	40055	Word	CH5 range-2 low alarm setting			K

**Word data [read-out/write-in]: Function code [03<sub>H</sub>, 06<sub>H</sub>, 10<sub>H</sub>]**

**User settings**

Relative address	Register No.	Data type	Memory contents	Read-out/write-in data	Remarks or corresponding parameter	Relevant model		
0037 <sub>H</sub>	40056	Word	CH1 alarm mode	0,1,2,3,4 (0: High limit alarm, 1: Low limit alarm, 2: High or low limit) 3: High-high limit alarm, 4: Low-low limit alarm	Alarm setting	R/K		
0038 <sub>H</sub>	40057	Word	CH2 alarm mode			R/K		
0039 <sub>H</sub>	40058	Word	CH3 alarm mode			R/K		
003A <sub>H</sub>	40059	Word	CH4 alarm mode			R/K		
003B <sub>H</sub>	40060	Word	CH5 alarm mode			K		
003C <sub>H</sub>	40061	Word	CH1 alarm switch	0,1 (0: Alarm OFF, 1: Alarm ON)		R/K		
003D <sub>H</sub>	40062	Word	CH2 alarm switch			R/K		
003E <sub>H</sub>	40063	Word	CH3 alarm switch			R/K		
003F <sub>H</sub>	40064	Word	CH4 alarm switch			R/K		
0040 <sub>H</sub>	40065	Word	CH5 alarm switch			K		
0041 <sub>H</sub>	40066	Word	Alarm hysteresis	0000H to 0014H (0 to 20%FS)		R/K		
0042 <sub>H</sub>	40067	Word	Auto calibration start time(day)	00H to 06H (Sun. to Sat.)	Setting of auto calibration	R/K		
0043 <sub>H</sub>	40068	Word	Auto calibration start time(hour)	00H to 23H (BCD code)		R/K		
0044 <sub>H</sub>	40069	Word	Auto calibration start time(min)	00H to 59H (BCD code)		R/K		
0045 <sub>H</sub>	40070	Word	Auto calibration cycle			R/K		
0046 <sub>H</sub>	40071	Word	Auto calibration cycle unit	0,1 (0: h, 1: days)		R/K		
0047 <sub>H</sub>	40072	Word	Auto calibration switch	0,1 (0: OFF, 1: ON)		R/K		
0048 <sub>H</sub>	40073	Word	Auto calibration gas flow time	003CH to 0257H (60 to 599 sec)		R/K		
0049 <sub>H</sub>	40074	Word	Key lock switch	0,1 (0: OFF, 1: ON)	Key lock	R/K		
004A <sub>H</sub>	40075	Word	Remote range switch	0,1 (0: OFF, 1: ON)	Remote range	R/K		
004B <sub>H</sub>	40076	Word	Response time 1	0000H to 0063H (0 to 99 sec) *(a)	Response time	R/K		
004C <sub>H</sub>	40077	Word	Response time 2			R/K		
004D <sub>H</sub>	40078	Word	Response time 3			R/K		
004E <sub>H</sub>	40079	Word	Response time 4			K		
004F <sub>H</sub>	40080	Word	Response time 5			K		
0050 <sub>H</sub>	40081	Word	Response time 6			K		
0051 <sub>H</sub>	40082	Word	Response time 7			K		
0052 <sub>H</sub>	40083	Word	Response time 8			K		
0053 <sub>H</sub>	40084	Word	Oxygen meter response time			R/K		
0054 <sub>H</sub>	40085	Word	1st order moving average period			0000H to 003bH (0 to 59 min or 1 to 4 h)	Average period	R/K
0055 <sub>H</sub>	40086	Word	2nd order moving average period					R/K
0056 <sub>H</sub>	40087	Word	3rd order moving average period	R/K				
0057 <sub>H</sub>	40088	Word	4th order moving average period	K				
0058 <sub>H</sub>	40089	Word	1st order moving average period unit	0,1 (0: h, 1: min)		R/K		
0059 <sub>H</sub>	40090	Word	2nd order moving average period unit			R/K		
005A <sub>H</sub>	40091	Word	3rd order moving average period unit			R/K		
005B <sub>H</sub>	40092	Word	4th order moving average period unit			K		

note) 3

note) 3

**Word data [read-out/write-in]: Function code [03<sub>H</sub>, 06<sub>H</sub>, 10<sub>H</sub>]**
**User settings**

Relative address	Register No.	Data type	Memory contents	Read-out/write-in data	Remarks or corresponding parameter	Relevant model
005C <sub>H</sub>	40093	Word	Hold switch	0,1 (0: OFF, 1: ON)	Output hold	R/K
005D <sub>H</sub>	40094	Word	Oxygen conversion reference value	01H to 13H(1% to 19%)	Oxygen conversion reference value	R/K
005E <sub>H</sub>	40095	Word	Peak alarm switch	0,1 (0: OFF, 1: ON)	Setting of peak alarm	
005F <sub>H</sub>	40096	Word	Peak alarm concentration	0064H to 03e8H (100 to 1000ppm)		
0060 <sub>H</sub>	40097	Word	Peak alarm count	0001H to 0063H (1 to 99 times)		R/K
0061 <sub>H</sub>	40098	Word	Peak alarm hysteresis	0000H to 0014H (0 to 20%FS)		R/K
0062 <sub>H</sub>	40099	Word	Auto zero calibration start (day)	00H to 06H (Sun. to Sat.)	Setting of auto zero calibration	R/K
0063 <sub>H</sub>	40100	Word	Auto zero calibration start (hour)	00H to 23H (BCD code)		R/K
0064 <sub>H</sub>	40101	Word	Auto zero calibration start (min)	00H to 59H (BCD code)		R/K
0065 <sub>H</sub>	40102	Word	Auto zero calibration cycle			R/K
0066 <sub>H</sub>	40103	Word	Auto zero calibration cycle unit	0,1 (0: h, 1: days)		R/K
0067 <sub>H</sub>	40104	Word	Auto zero calibration switch	0,1 (0: OFF, 1: ON)		R/K
0068 <sub>H</sub>	40105	Word	Auto zero calibration gas flow time	003CH to 0257H (60 to 599 sec)		R/K
0069 <sub>H</sub>	40106	Word	CH1 range change setting	0,1 (0: range-1, 1: range-2)	Range changeover (disabled if remote range ON)	R/K
006A <sub>H</sub>	40107	Word	CH2 range change setting			R/K
006B <sub>H</sub>	40108	Word	CH3 range change setting			R/K
006C <sub>H</sub>	40109	Word	CH4 range change setting			R/K
006D <sub>H</sub>	40110	Word	CH5 range change setting			K
006E <sub>H</sub>	40111	Word	Ch1 range change method	0,1,2 (0:manual, 1:remote, 2:auto)		3
006F <sub>H</sub>	40112	Word	Ch2 range change method			3
0070 <sub>H</sub>	40113	Word	Ch3 range change method			3
0071 <sub>H</sub>	40114	Word	Ch4 range change method			3
0072 <sub>H</sub>	40115	Word	Ch5 range change method			3
0073 <sub>H</sub>	40116	Word	Ch1 auto calibration range	0,1 (0:range-1, 1:range-2)		3
0074 <sub>H</sub>	40117	Word	Ch2 auto calibration range			3
0075 <sub>H</sub>	40118	Word	Ch3 auto calibration range			3
0076 <sub>H</sub>	40119	Word	Ch4 auto calibration range			3
0077 <sub>H</sub>	40120	Word	Ch5 auto calibration range			3
0078 <sub>H</sub>	40121	Word	Alarm 1 target channel	0,1,2,3,4,5,6		3
0079 <sub>H</sub>	40122	Word	Alarm 2 target channel			3
007A <sub>H</sub>	40123	Word	Alarm 3 target channel			3
007B <sub>H</sub>	40124	Word	Alarm 4 target channel			3
007C <sub>H</sub>	40125	Word	Alarm 5 target channel			3
007D <sub>H</sub>	40126	Word	Alarm 6 target channel			3
007E <sub>H</sub>	40127	Word	alarm-6 range-1 high alarm setting	0 to 9999 Decimal point position depends on range	Alarm-6 setting	3
007F <sub>H</sub>	40128	Word	alarm-6 range-1 low alarm setting			3
0080 <sub>H</sub>	40129	Word	alarm-6 range-2 high alarm setting			3
0081 <sub>H</sub>	40130	Word	alarm-6 range-2 low alarm setting			3

**Word data [read-out/write-in]: Function code [03<sub>H</sub>, 06<sub>H</sub>, 10<sub>H</sub>]**
**User settings**

Relative address	Register No.	Data type	Memory contents	Read-out/write-in data	Remarks or corresponding parameter	Relevant model
0082 <sub>H</sub>	40131	Word	alarm-6 alarm mode	same as alarm Ch1 to 5		3
0083 <sub>H</sub>	40132	Word	alarm-6 alarm switch	same as alarm Ch1 to 5		3
0084 <sub>H</sub>	40133	Word	auto calibration gas flow time 1	003Ch to 0384H (60 to 900 sec)		3
0085 <sub>H</sub>	40134	Word	auto calibration gas flow time 2			3
0086 <sub>H</sub>	40135	Word	auto calibration gas flow time 3			3
0087 <sub>H</sub>	40136	Word	auto calibration gas flow time 4			3
0088 <sub>H</sub>	40137	Word	auto calibration gas flow time 5			3
0089 <sub>H</sub>	40138	Word	auto calibration gas flow time 6			3
008A <sub>H</sub>	40139	Word	auto calibration gas flow time 7			3
008B <sub>H</sub>	40140	Word	Hold change	(0: Last value, 1: Setting)		3
008C <sub>H</sub>	40141	Word	Ch1 hold set value	0 to 100 (%FS)		3
008D <sub>H</sub>	40142	Word	Ch2 hold set value			3
008E <sub>H</sub>	40143	Word	Ch3 hold set value			3
008F <sub>H</sub>	40144	Word	Ch4 hold set value			3
0090 <sub>H</sub>	40145	Word	Ch5 hold set value			3
0091 <sub>H</sub>	40146	Word	Blowback start (day)	00H to 06H (Sun. to Sat.)	Blowback setting (Option)	3
0092 <sub>H</sub>	40147	Word	Blowback start (hour)	00H to 23H (BCD code)		3
0093 <sub>H</sub>	40148	Word	Blowback start (min)	00H to 59H (BCD code)		3
0094 <sub>H</sub>	40149	Word	Blowback cycle	1 to 99 (h), 1 to 7 (days)		3
0095 <sub>H</sub>	40150	Word	Blowback cycle unit	0,1 (0:h, 1:days)		3
0096 <sub>H</sub>	40151	Word	Blowback switch	0,1 (0:OFF, 1:ON)		3
0097 <sub>H</sub>	40152	Word	Gas displacement time after blowback	003Ch to 0384H (60 to 900 sec)		3
0098 <sub>H</sub>	40153	Word	Measurement point change cycle	1 to 60 (min), 1 to 99 (h)	Measurement point change setting (Option)	3
0099 <sub>H</sub>	40154	Word	Measurement point change cycle unit	0,1 (0:min, 1:h)		3
009A <sub>H</sub>	40155	Word	Measurement point change displacement time	003Ch to 0384H (60 to 900 min)		3
009B <sub>H</sub>	40156	Word	Measurement point change setting	0,1,2 (0: Line 1, 1: Line 2, 2: Change)		3

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**Word data [write-in] : Function code [06<sub>H</sub>]****Operation command**

Relative address	Register No.	Data type	Memory contents	Write-in data	Remarks or corresponding parameter	Relevant model
07D0 <sub>H</sub>	42001	Word	Keying command	01H:MODE 02H: Side, 04H: Up, 08H: Down 10H: ESC, 20H: ENT 40H: ZERO, 80H: SPAN	Sending a value simulates keying	R/K
07D1 <sub>H</sub>	42002	Word	Display change	1: Return to measurement mode display	Force to return to measurement mode	R/K
07D2 <sub>H</sub>	42003	Word	Auto calibration	1; Execute auto calibration	Auto calibration is executed only once.	3/5
07D3 <sub>H</sub>	42004	Word	Auto zero calibration	1; Execute auto zero calibration	Auto zero calibration is executed only once.	3/5
07D4 <sub>H</sub>	42005	Word	Blowback	1; Execute blowback	Blowback is executed only once. (Option)	3



**Word data [read-out only] : Function code[04<sub>H</sub>]**

**Measurement value and status**

Relative address	Register No.	Data type	Memory contents	Read-out data	Remarks or corresponding parameter	Relevant model
0000 <sub>H</sub>	30001	Word	CH1 concentration	Concentration: -9999 to 9999 (value corresponding to indication without decimal point) Decimal point position: 0,1,2,3 (0; concentration/1 1; concentration/10 2; concentration/100 3; concentration/1000) Measurement unit: 0, 1, 2, 3 (0; vol% 1; ppm 2; mg/m <sup>3</sup> 3; g/m <sup>3</sup> )  Transmit values under current measurement conditions		R/K
0001 <sub>H</sub>	30002	Word	CH1 decimal point position			R/K
0002 <sub>H</sub>	30003	Word	CH1 measurement unit			R/K
0003 <sub>H</sub>	30004	Word	CH2 concentration			R/K
0004 <sub>H</sub>	30005	Word	CH2 decimal point position			R/K
0005 <sub>H</sub>	30006	Word	CH2 measurement unit			R/K
0006 <sub>H</sub>	30007	Word	CH3 concentration			R/K
0007 <sub>H</sub>	30008	Word	CH3 decimal point position			R/K
0008 <sub>H</sub>	30009	Word	CH3 measurement unit			R/K
0009 <sub>H</sub>	30010	Word	CH4 concentration			R/K
000A <sub>H</sub>	30011	Word	CH4 decimal point position			R/K
000B <sub>H</sub>	30012	Word	CH4 measurement unit			R/K
000C <sub>H</sub>	30013	Word	CH5 concentration			R/K
000D <sub>H</sub>	30014	Word	CH5 decimal point position			R/K
000E <sub>H</sub>	30015	Word	CH5 measurement unit			R/K
000F <sub>H</sub>	30016	Word	CH6 concentration			R/K
0010 <sub>H</sub>	30017	Word	CH6 decimal point position			R/K
0011 <sub>H</sub>	30018	Word	CH6 measurement unit			R/K
0012 <sub>H</sub>	30019	Word	CH7 concentration			R/K
0013 <sub>H</sub>	30020	Word	CH7 decimal point position			R/K
0014 <sub>H</sub>	30021	Word	CH7 measurement unit			R/K
0015 <sub>H</sub>	30022	Word	CH8 concentration			R/K
0016 <sub>H</sub>	30023	Word	CH8 decimal point position			R/K
0017 <sub>H</sub>	30024	Word	CH8 measurement unit			R/K
0018 <sub>H</sub>	30025	Word	CH9 concentration			K
0019 <sub>H</sub>	30026	Word	CH9 decimal point position			K
001A <sub>H</sub>	30027	Word	CH9 measurement unit			K
001B <sub>H</sub>	30028	Word	CH10 concentration			K
001C <sub>H</sub>	30029	Word	CH10 decimal point position			K
001D <sub>H</sub>	30030	Word	CH10 measurement unit			K
001E <sub>H</sub>	30031	Word	CH11 concentration			K
001F <sub>H</sub>	30032	Word	CH11 decimal point position			K
0020 <sub>H</sub>	30033	Word	CH11 measurement unit			K
0021 <sub>H</sub>	30034	Word	CH12 concentration			K
0022 <sub>H</sub>	30035	Word	CH12 decimal point position			K
0023 <sub>H</sub>	30036	Word	CH12 measurement unit			K

**Word data [read-out only] : Function code[04<sub>H</sub>]**

**Measurement value and status**

Relative address	Register No.	Data type	Memory contents	Read-out data	Remarks or corresponding parameter	Relevant model
0024 <sub>H</sub>	30037	Word	Peak count	0 to 100 times/hour		R/K
0025 <sub>H</sub>	30038	Word	CH1 current range	0, 1 (0; range-1, 1;range-2)		R/K
0026 <sub>H</sub>	30039	Word	CH2 current range			R/K
0027 <sub>H</sub>	30040	Word	CH3 current range			R/K
0028 <sub>H</sub>	30041	Word	CH4 current range			R/K
0029 <sub>H</sub>	30042	Word	CH5 current range			K
002A <sub>H</sub>	30043	Word	CH1 high/low limit alarm	0, 1, 2, 3, 4 (0: No alarm, 1: High limit alarm, 2: Low limit alarm 3: High-high limit alarm, 4: Low-low limit alarm	Whether or how alarm is currently produced.	R/K
002B <sub>H</sub>	30044	Word	CH2 high/low limit alarm			R/K
002C <sub>H</sub>	30045	Word	CH3 high/low limit alarm			R/K
002D <sub>H</sub>	30046	Word	CH4 high/low limit alarm			R/K
002E <sub>H</sub>	30047	Word	CH5 high/low limit alarm			K
002F <sub>H</sub>	30048	Word	Peak count alarm	0,1 (0: No, 1: Yes)		R/K
0030 <sub>H</sub>	30049	Word	Auto (Auto zero) calibration in progress	0,1 (0: No, 1: Yes)		R/K
0031 <sub>H</sub>	30050	Word	CH1 zero calibration in progress	0,1 (0: No, 1: Yes)		R/K
0032 <sub>H</sub>	30051	Word	CH2 zero calibration in progress			R/K
0033 <sub>H</sub>	30052	Word	CH3 zero calibration in progress			R/K
0034 <sub>H</sub>	30053	Word	CH4 zero calibration in progress			R/K
0035 <sub>H</sub>	30054	Word	CH5 zero calibration in progress			K
0036 <sub>H</sub>	30055	Word	CH1 span calibration in progress			R/K
0037 <sub>H</sub>	30056	Word	CH2 span calibration in progress			R/K
0038 <sub>H</sub>	30057	Word	CH3 span calibration in progress			R/K
0039 <sub>H</sub>	30058	Word	CH4 span calibration in progress			R/K
003A <sub>H</sub>	30059	Word	CH5 span calibration in progress			K
003B <sub>H</sub>	30060	Word	Instrument error	0,1 (0: No, 1; Yes)	Whether error is produced	R/K
003C <sub>H</sub>	30061	Word	Calibration error	0,1 (0: No, 1; Yes)	Whether error is produced	R/K
003D <sub>H</sub>	30062	Word	Latest error No.	-1 to 9 (Error No.-1) * (b) 0 to 6 (Sun. to Sat.) 0 to 23 (hours) 0 to 59 (min) 0 to 4	Error log contents (Date of the month appears in the WEEK data field with improved ZKJ version 3.)	R/K
003E <sub>H</sub>	30063	Word	Latest error WEEK			R/K
003F <sub>H</sub>	30064	Word	Latest error HOUR			R/K
0040 <sub>H</sub>	30065	Word	Latest error MIN			R/K
0041 <sub>H</sub>	30066	Word	Latest error TARGET			R/K

**Word data [read-out only] : Function code[04<sub>H</sub>]**

**Measurement value and status**

Relative address	Register No.	Data type	Memory contents	Read-out data	Remarks or corresponding parameter	Relevant model
0042 <sub>H</sub>	30067	Word	The previous error No.	-1 to 9 (Error No.-1)		R/K
0043 <sub>H</sub>	30068	Word	The previous error WEEK	0 to 6 (Sun. to Sat.)		R/K
0044 <sub>H</sub>	30069	Word	The previous error HOUR	0 to 23 (hours)		R/K
0045 <sub>H</sub>	30070	Word	The previous error MIN	0 to 59 (min)		R/K
0046 <sub>H</sub>	30071	Word	The previous error TARGET	0 to 4		R/K
						R/K
						R/K
007E <sub>H</sub>	30127	Word	Oldest error No.	-1 to 9 (Error No.-1)		R/K
007F <sub>H</sub>	30128	Word	Oldest error WEEK	0 to 6 (Sun. to Sat.)		R/K
0080 <sub>H</sub>	30129	Word	Oldest error HOUR	0 to 23 (hour)		R/K
0081 <sub>H</sub>	30130	Word	Oldest error MIN	0 to 59 (min)	R/K	
0082 <sub>H</sub>	30131	Word	Oldest error TARGET	0 to 4	R/K	
0083 <sub>H</sub>	30132	Word	Error 1	0,1 (0: No, 1: Yes)	Whether error is currently produced	R/K
0084 <sub>H</sub>	30133	Word	Error 2			R
0085 <sub>H</sub>	30134	Word	Error 3			R
0086 <sub>H</sub>	30135	Word	Error 10			R/K
0087 <sub>H</sub>	30136	Word	CH1 Error 4	0,1 (0: No, 1: Yes)		R/K
0088 <sub>H</sub>	30137	Word	CH1 Error 5			R/K
0089 <sub>H</sub>	30138	Word	CH1 Error 6			R/K
008A <sub>H</sub>	30139	Word	CH1 Error 7			R/K
008B <sub>H</sub>	30140	Word	CH1 Error 8			R/K
008C <sub>H</sub>	30141	Word	CH1 Error 9			R/K
					R/K	
					R/K	
0099 <sub>H</sub>	30154	Word	CH4 Error 4	0,1 (0: No, 1: Yes)	R/K	
009A <sub>H</sub>	30155	Word	CH4 Error 5		R/K	
009B <sub>H</sub>	30156	Word	CH4 Error 6		R/K	
009C <sub>H</sub>	30157	Word	CH4 Error 7		R/K	
009D <sub>H</sub>	30158	Word	CH4 Error 8		R/K	
009E <sub>H</sub>	30159	Word	CH4 Error 9		R/K	
009F <sub>H</sub>	30160	Word	CH5 Error 4	0,1 (0: No, 1: Yes)	K	
00A0 <sub>H</sub>	30161	Word	CH5 Error 5		K	
00A1 <sub>H</sub>	30162	Word	CH5 Error 6		K	
00A2 <sub>H</sub>	30163	Word	CH5 Error 7		K	
00A3 <sub>H</sub>	30164	Word	CH5 Error 8		K	
00A4 <sub>H</sub>	30165	Word	CH5 Error 9		K	

**Word data [read-out only] : Function code[04<sub>H</sub>]**

**Measurement value and status**

Relative address	Register No.	Data type	Memory contents	Read-out data	Remarks or corresponding parameter	Relevant model
00A5 <sub>H</sub>	30166	Word	CH1 auto zero calibration in progress	0,1 (0: No, 1: Yes)		R/K
00A6 <sub>H</sub>	30167	Word	CH1 auto span calibration in progress			R/K
00A7 <sub>H</sub>	30168	Word	CH1 hold in progress	0,1 (0: No, 1: Yes)		R/K
						R/K
						R/K
00AE <sub>H</sub>	30175	Word	CH4 auto zero calibration in progress	0,1 (0: No, 1: Yes)		R/K
00AF <sub>H</sub>	30176	Word	CH4 auto span calibration in progress			R/K
00B0 <sub>H</sub>	30177	Word	CH4 hold in progress	0,1 (0: No, 1: Yes)		R/K
00B1 <sub>H</sub>	30178	Word	CH5 auto zero calibration in progress	0,1 (0: No, 1: Yes)		K
00B2 <sub>H</sub>	30179	Word	CH5 auto span calibration in progress			K
00B3 <sub>H</sub>	30180	Word	CH5 hold in progress	0,1 (0: No, 1: Yes)		K
00B4 <sub>H</sub>	30181	Word	Display information (1)	* (c)		R/K
00B5 <sub>H</sub>	30182	Word	Display information (2)			R/K
00B6 <sub>H</sub>	30183	Word	Display information (3)			R/K
00B7 <sub>H</sub>	30184		(Do not use)			
00B8 <sub>H</sub>	30185		(Do not use)			
00B9 <sub>H</sub>	30186		(Do not use)			
00BA <sub>H</sub>	30187		(Do not use)			
00BB <sub>H</sub>	30188		(Do not use)			
00BC <sub>H</sub>	30189	Word	Manual calibration channel	Cursor CH-1 * (d)		R/K
00BD <sub>H</sub>	30190		(Do not use)			
00BE <sub>H</sub>	30191	Word	High/Low limit alarm (6)			3
00BF <sub>H</sub>	30192		(Do not use)			
00C0 <sub>H</sub>	30193		(Do not use)			
00C1 <sub>H</sub>	30194		(Do not use)			

**Word data [read-out only] : Fuction code[04<sub>H</sub>]**

**Fixed setting**

Relative address	Register No.	Data type	Memory contents	Read-out data	Remarks or corresponding parameter	Relevant model
0425 <sub>H</sub>	31062	Word	CH1 range numbers	1, 2 (1: 1 range, 2: 2 ranges)		R/K
0426 <sub>H</sub>	31063	Word	CH2 range numbers			R/K
0427 <sub>H</sub>	31064	Word	CH3 range numbers			R/K
0428 <sub>H</sub>	31065	Word	CH4 range numbers			R/K
0429 <sub>H</sub>	31066	Word	CH5 range numbers			K
042A <sub>H</sub>	31067	Word	CH1 range-1 unit	0,1,2,3 (0;vol% 1; ppm 2; mg/m3 3; g/m3)		R/K
042B <sub>H</sub>	31068	Word	CH1 range-2 unit			R/K
042C <sub>H</sub>	31069	Word	CH2 range-1 unit			R/K
042D <sub>H</sub>	31070	Word	CH2 range-2 unit			R/K
042E <sub>H</sub>	31071	Word	CH3 range-1 unit			R/K
042F <sub>H</sub>	31072	Word	CH3 range-2unit			R/K
0430 <sub>H</sub>	31073	Word	CH4 range-1 unit			R/K
0431 <sub>H</sub>	31074	Word	CH4 range-2 unit			R/K
0432 <sub>H</sub>	31075	Word	CH5 range-1 unit			K
0433 <sub>H</sub>	31076	Word	CH5 range-2 unit			K
0434 <sub>H</sub>	31077	Word	CH1 range-1 value	1 to 9999	With improved ZKJ version 3, the actual range value is calculated with the decimal point position taken into consideration. Actual range value = Read range value / X (X is 1 when 0 is selected, 10 when 1 is selected, and 100 when 2 is selected, and 1000 when 3 is selected for decimal point position.)	R/K
0435 <sub>H</sub>	31078	Word	CH1 range-2 value			R/K
0436 <sub>H</sub>	31079	Word	CH2 range-1 value			R/K
0437 <sub>H</sub>	31080	Word	CH2 range-2 value			R/K
0438 <sub>H</sub>	31081	Word	CH3 range-1 value			R/K
0439 <sub>H</sub>	31082	Word	CH3 range-2 value			R/K
043A <sub>H</sub>	31083	Word	CH4 range-1 value			R/K
043B <sub>H</sub>	31084	Word	CH4 range-2 value			R/K
043C <sub>H</sub>	31085	Word	CH5 range-1 value			K
043D <sub>H</sub>	31086	Word	CH5 range-2 value			K
043E <sub>H</sub>	31087	Word	CH1 range-1 decimal point position	0,1,2,3 (0: Nothing below decimal point, 1: 1 digit below decimal point, 2: 2 digits below decimal point, 3: 3 digits below decimal point.		R/K
043F <sub>H</sub>	31088	Word	CH1 range-2 decimal point position			R/K
0440 <sub>H</sub>	31089	Word	CH2 range-1 decimal point position			R/K
0441 <sub>H</sub>	31090	Word	CH2 range-2 decimal point position			R/K
0442 <sub>H</sub>	31091	Word	CH3 range-1 decimal point position			R/K
0443 <sub>H</sub>	31092	Word	CH3 range-2 decimal point position			R/K
0444 <sub>H</sub>	31093	Word	CH4 range-1 decimal point position			R/K
0445 <sub>H</sub>	31094	Word	CH4 range-2 decimal point position			R/K
0446 <sub>H</sub>	31095	Word	CH5 range-1 decimal point position			K
0447 <sub>H</sub>	31096	Word	CH5 range-2 decimal point position			K

**Word data [read-out only] : Fuction code[04<sub>H</sub>]**

**Fixed setting**

Relative address	Register No.	Data type	Memory contents	Read-out data	Remarks or corresponding parameter	Relevant model
0448 <sub>H</sub>	31097	Word	Type: first digit	Z		3/5
0449 <sub>H</sub>	31098	Word	Type: second digit	K or R		3/5
044A <sub>H</sub>	31099	Word	Type: third digit	J		3/5
044B <sub>H</sub>	31100	Word	Type: fourth digit	0 to 9, A to Z		3/5
044C <sub>H</sub>	31101	Word	Type: fifth digit	0 to 9, A to Z		3/5
044D <sub>H</sub>	31102	Word	Type: sixth digit	0 to 9, A to Z		3/5
044E <sub>H</sub>	31103	Word	Type: seventh digit	0 to 9, A to Z		3/5
044F <sub>H</sub>	31104	Word	Type: eighth digit	3 or 5		3/5
0450 <sub>H</sub>	31105	Word	Type: ninth digit	0 to 9, A to Z		3/5
0451 <sub>H</sub>	31106	Word	Type: tenth digit	0 to 9, A to Z		3/5
0452 <sub>H</sub>	31107	Word	Type: eleventh digit	0 to 9, A to Z		3/5
0453 <sub>H</sub>	31108	Word	Type: twelfth digit	0 to 9, A to Z		3/5
0454 <sub>H</sub>	31109	Word	Type: thirteenth digit	0 to 9, A to Z		3/5
0455 <sub>H</sub>	31110	Word	Type: fourteenth digit	0 to 9, A to Z		3/5
0456 <sub>H</sub>	31111	Word	Type: fifteenth digit	0 to 9, A to Z		3/5
0457 <sub>H</sub>	31112	Word	Type: sixteenth digit	0 to 9, A to Z		3/5
0458 <sub>H</sub>	31113	Word	Type: seventeenth digit	0 to 9, A to Z		3/5
0459 <sub>H</sub>	31114	Word	Type: eighteenth digit	0 to 9, A to Z		3/5
045A <sub>H</sub>	31115	Word	Type: nineteenth digit	0 to 9, A to Z		3/5
045B <sub>H</sub>	31116	Word	Type: twentieth digit	0 to 9, A to Z		3/5
045C <sub>H</sub>	31117	Word	Type: twenty first digit	0 to 9, A to Z		3/5
045D <sub>H</sub>	31118	Word	Type: twenty second digit	0 to 9, A to Z		3/5
045E <sub>H</sub>	31119	Word	Type: twenty third digit	0 to 9, A to Z		3
045F <sub>H</sub>	31120	Word	Type: twenty fourth digit	0 to 9, A to Z		3
0460 <sub>H</sub>	31121	Word	Board: first digit	0 to 9, A to Z		3/5
0461 <sub>H</sub>	31122	Word	Board: second digit	0 to 9, A to Z		3/5
0462 <sub>H</sub>	31123	Word	Board: third digit	0 to 9, A to Z		3/5
0463 <sub>H</sub>	31124	Word	Board: fourth digit	0 to 9, A to Z		3/5
0464 <sub>H</sub>	31125	Word	Board: fifth digit	0 to 9, A to Z		3/5
0465 <sub>H</sub>	31126	Word	Board: sixth digit	0 to 9, A to Z		3/5
0466 <sub>H</sub>	31127	Word	Board: seventh digit	0 to 9, A to Z		3/5
0467 <sub>H</sub>	31128	Word	Board: eighth digit	0 to 9, A to Z		3/5

**Notes**

1. Relevant model: R: ZRJ, K: ZKJ.  
For data for which only K or R is indicated, there is no data for the other model.  
The addresses marked with "3" is used for improved ZKJ version 3 only.  
The addresses marked with "3/5" is used for improved ZKJ version 3 and improved ZRJ version 5 only.
2. For contents of \*(a) to \*(d), refer to Section 7.3 "Supplements to address map".
3. There is no data improved ZKJ version 3.

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## 7.3 Supplement to address map

\* (a) Register No. 40076 to 40083 (response time 1 to 8)

The following shows signals corresponding to response time 1 to 8.

- ZRJ

Response time 1	1st component detector signal
Response time 2	2nd component detector signal
Response time 3	3rd component detector signal
Response time 4 to 8	Unused

The above does not include sensor signals of oxygen.

- ZKJ

Response time 1	1st component measurement detector signal
Response time 2	1st component interference compensation detector signal
Response time 3	2nd component measurement detector signal
Response time 4	2nd component interference compensation detector signal
Response time 5	3rd component measurement detector signal
Response time 6	3rd component interference compensation detector signal
Response time 7	4th component measurement detector signal
Response time 8	4th component interference compensation detector signal

The above does not include sensor signals of oxygen.

\* (b) Register No. 30062 to 30131 (error log)

Up to 14 errors logged can be read in the order from the latest to older ones.

The contents are as follows.

Error No.: No. of produced error. Stored value is error number minus 1.

Error WEEK: Day when error occurred.

Error HOUR: Indicates at what o'clock error occurred.

Error MIN: Indicates at what minutes error occurred.

Error TARGET: No. of CH where error occurred.

CH No. minus 1 is stored.

0 at error No. 1, 2, 3 or 10.

No. of optical system where error occurred minus 1 if error No. is 1 in case of ZKJ.

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\* (c) Register numbers 30181, 30182, 30183 (display information (1), (2), (3))

The display information is values for knowing the current display status of the instrument.

- Contents of values of display information (1) (status of each setting panel)

- 0: Measurement mode display (manual calibration display included)
- 1: Menu mode display
- 2: Changeover of range display
- 3: Calibration setting display
- 4: Alarm setting display
- 5: Automatic calibration setting display
- 6: Peak alarm setting display
- 7: Parameter setting display
- 8: Maintenance mode display
- 9: Factory mode display
- 10: Auto zero calibration setting display

- Contents of values of display information (2) (status at manual calibration)

- 0: Measurement mode display
- 4: Channel selection display at manual zero calibration
- 5: Zero calibration wait display at manual zero calibration
- 6: Zero calibration in progress display at manual zero calibration
- 7: Channel selection display at manual span calibration
- 8: Span calibration wait display at manual span calibration
- 9: Span calibration in progress display at manual span calibration
- 10: Error contents indication display

- Contents of values of display information (3)

Correspond to value of CH (channel) from which the measurement mode is displayed.  
Top channel number minus 1 is stored.

\* (d) Register number 30189 (manual calibration channel)

Data for knowing a channel (component) which the cursor is positioned at to carry out a calibration at when a manual calibration is under way.

Channel number to carry out a calibration at minus 1 is stored.



## 8. TROUBLESHOOTING

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If the communication is unavailable, check the following items.

- ☐ Whether all devices related to communication are turned on.
- ☐ Whether connections are correct.
- ☐ Whether the number of connected instruments and connection distance are as specified
- ☐ Whether communication conditions coincide between the master station (host computer) and slave stations (instrument)
  - ☐ Transmission speed : 9600bps
  - ☐ Data length : 8 bits
  - ☐ Stop bit : 1 bit
  - ☐ Parity : None
- ☐ Whether send/receive signal timing conforms to Section 5.6 in this manual.
- ☐ Whether the station No. designated as send destination by the master station coincides with the station No. of the connected instrument.
- ☐ Whether more than one instrument connected on the same transmission line shares the same station No.
- ☐ Whether the station No. of instruments is set at other than 0.  
If it's 0, the communication function does not work.

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## **Fuji Electric Co., Ltd.**

### **International Sales Div Sales Group**

Gate City Ohsaki, East Tower, 11-2, Osaki 1-chome,  
Shinagawa-ku, Tokyo 141-0032, Japan  
<http://www.fujielectric.com>  
Phone: 81-3-5435-7280, 7281 Fax: 81-3-5435-7425  
<http://www.fujielectric.com/products/instruments/>

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# INFRARED GAS ANALYZER FOR STACK GAS

## DATA SHEET

**ZSU-5**

This analyzer consists of an infrared gas analyzer, an O<sub>2</sub> sensor and a gas sampling device. It is used for simultaneous and continuous measurement of the NO<sub>x</sub>, SO<sub>2</sub>, CO, CO<sub>2</sub> and O<sub>2</sub> components in the flue gas of various boilers, garbage incinerators, etc.

For CO and O<sub>2</sub> measurement specifications, the function for coping with the Japanese regulation on dioxin emission is incorporated.

## FEATURES

1. Gas concentrations of 5 components is measurable simultaneously and continuously  
NO<sub>x</sub>, SO<sub>2</sub>, CO and CO<sub>2</sub> gas concentration measurements are integrated by infrared method, to which a zirconia or magnetic type O<sub>2</sub> sensor is added for O<sub>2</sub> measurement. Therefore, the gas concentrations of 5 components are simultaneously and continuously measurable.
2. The use of highly sensitive and reliable mass flow detector allows the range ratio of up to 1:25 with the standard 2 range.
3. Maintenance can be performed from the front side, thus saving the installation space.  
Unitized structure of the analyzing block and gas sampling module enables better maintenance.
4. Provided with abundant functions including O<sub>2</sub> correction output, average value output, automatic calibration, CO peak count alarm, automatic range changeover, and alarms.
5. N<sub>2</sub>O and CH<sub>4</sub> can also be measured as an optional feature.  
Having warming effect 300 times as high as that of CO<sub>2</sub>, N<sub>2</sub>O is the greenhouse gas most controversial now.

## SPECIFICATIONS

### 1. Standard Specifications

#### •Measuring system :

NO<sub>x</sub>, SO<sub>2</sub>, CO and CO<sub>2</sub> ; Ndir type infrared

O<sub>2</sub> ; Zirconia type, magnetic type

#### •Measurable component and min./max. measurement range :

NO<sub>x</sub> ; 0 to 50ppm/0 to 5000ppm

SO<sub>2</sub> ; 0 to 50ppm/0 to 5000ppm

CO ; 0 to 50ppm/0 to 5000ppm

CO<sub>2</sub> ; 0 to 10%/0 to 20%

O<sub>2</sub> ; 0 to 10%/0 to 25%

N<sub>2</sub>O and CH<sub>4</sub> can be measured as an optional feature.

#### •Number of measurement ranges :

2 Maximum range ratio: 1:25 (Refer to Code Symbols.)

#### •Warm-up time : Within 4 hours after power-on



#### •Analog output signals :

Simultaneous output of signals of 4 to 20 mA DC each (non-isolated or isolated depending on customer's code selection)

- Five instantaneous value outputs (NO<sub>x</sub>, SO<sub>2</sub>, CO, CO<sub>2</sub> and O<sub>2</sub>)

- Three instantaneous values (NO<sub>x</sub>, SO<sub>2</sub>, CO) after O<sub>2</sub> correction when provided with O<sub>2</sub> sensor

- Three average values (NO<sub>x</sub>, SO<sub>2</sub>, CO) after O<sub>2</sub> correction when provided with O<sub>2</sub> sensor

- Allowable load resistance :  
550 Ω or less (750 Ω or less for isolated output)

#### •Contact output: (1) Each 1a contact (contact capacity 250 V AC, 2 A or 30 V DC, 3 A) for:

- Range identification of each component (Close/1st range) , analyzing block error, calibration error, auto calibration status, maintenance status, and CO peak count alarm

(2) Each 1c contact (contact capacity 250V AC, 1 A or 30 V DC, 1 A) for:

- Concentration alarm for each component's instantaneous value (H, L, HL settable), analyzing block power off

- **Contact input :** Non-voltage contact (1.5 sec or longer)
  - Auto calibration start, average value resetting
 Non-voltage contact (Status holded)
  - Range changeover (1st range when contact closes), output hold, remote pump OFF (OFF when contact closes)
- **Indication :** LCD with back light for indicating:
  - Instantaneous values (NO<sub>x</sub>, SO<sub>2</sub>, CO, CO<sub>2</sub> and O<sub>2</sub>)
  - O<sub>2</sub> corrected instantaneous values (NO<sub>x</sub>, SO<sub>2</sub>, CO) after O<sub>2</sub> correction when provided with O<sub>2</sub> sensor
  - O<sub>2</sub> corrected average values (NO<sub>x</sub>, SO<sub>2</sub>, CO) after O<sub>2</sub> correction when provided with O<sub>2</sub> sensor
  - O<sub>2</sub> average value when provided with O<sub>2</sub> sensor
  - Peak count value (when provided with CO, O<sub>2</sub> analyzer)
  - Parameter assignment
- **Fluorescent lamp in cubicle :** Standard equipment
- **Recorder (option) :** Paperless recorder (Fuji Electric's type PHR) mounted
- **Gas extractor :** Electrical heating type (filter built in)
  - Wire mesh filter : 40μm mesh of SUS 316 stainless steel
  - Flange : JIS 5K 65AFF
  - Mass: Approx. 9 kg (excluding gas sampling pipe)
  - Power supply voltage: 100 V AC, 50/60 Hz
  - Power consumption: Approx 100 VA
  - Sampling pipe: Refer to Code Symbols for materials and length of the pipe.  
SUS 316 (length 300, 400, 600, 800, 1000 mm), or titanium (length 600, 800, 1000 mm), or SiC (length 700, 900 mm)
  - \* SUS 316 is used for 800°C or lower.
  - \* Titanium is used for 1000°C or lower.
  - \* SiC is used for 1300°C or lower.
- **Sample inlet tube :**
  - Ø10 / Ø8 Teflon tube or heating tube (max. 30 m)
  - \* The heating tube needs to be specified in the following cases.
    - (1) Ambient temperature -5°C or lower
    - (2) SO<sub>2</sub> of 50 or 100 ppm
    - (3) Tube length 10 m or longer in SO<sub>2</sub> measurement
  - (Power supply voltage: 100 V AC, 50/60 Hz, power consumption: 36 VA/m)
- **Rated operating conditions :**
  - Ambient temperature: -5 to 40°C (depending on customer's code selection)
  - Ambient humidity: 90% RH or less
  - Power supply voltage: 100, 110, 115, 200 or 230 V AC ±15% (Fluorescent lamp: ± 10%)  
(depending on customer's code selection)
  - Frequency: 50 or 60 Hz ±0.5 Hz
- **Power consumption:** Max. 600 VA (excluding gas extractor and heating tube)
- **Storage condition:**
  - Ambient temperature; -20 to 60°C (Water within the drain pot should be drained before storage.)
  - Ambient humidity; 95%RH or lower (Required for a oil/coal boiler or when the first range of the SO<sub>2</sub> meter for gas dryer purging is 500 ppm or higher.)  
Dew point; -20°C DP or lower  
Pressure; 100 kPa to 400 kPa  
Dust and mist; None
- **Dry air :**
- **External dimensions (H x W x D) :**
  - Indoor type; 1710 x 800 x 615 mm
  - Outdoor type; 1780 x 815 x 700 mm
- **Mass :** Approx. 300 kg (excluding standard gas)
- **Cubicle finish color :** Munsell 5Y7/1 semi-gloss
- **Cubicle structure :** Indoor or outdoor installation, of self-standing type, single-swing front door, plate thickness 2.3 mm standard (both cubicle and door)
- **Other :** Six standard gas cylinders (3.4 L) accommodatable  
Note: Fluctuation in the operation period of 4 hours from the end of warm-up time is within ±2%FS.
- **Measurement Law type approval No.:**
  - SAN991-1 (NO<sub>x</sub> analyzer)
  - SAS992-1 (SO<sub>2</sub> analyzer)
  - SAC992-1 (CO analyzer)
  - SE981 (Zirconia O<sub>2</sub> sensor)
  - SF011 (Magnetic O<sub>2</sub> sensor)

## 2. Standard Functions

Function	Description
O <sub>2</sub> Correction	<ul style="list-style-type: none"> <li>Conversion of measured NO<sub>x</sub>, SO<sub>2</sub> and CO gas concentrations into values at standard O<sub>2</sub> concentration</li> </ul> <p>Calculating equation : <math>C = \frac{Cs (21-O_N)}{21-O_s}</math></p> <p> C : Sample gas concentration after O<sub>2</sub> correction  Cs : Measured concentration of sample gas  Os : Measured O<sub>2</sub> concentration  ON : Standard O<sub>2</sub> concentration (4% for petroleum fuel, 5% for gas fuel, 6% for coal fuel, 12% for garbage incinerator)  Setting range: 0 to 19% </p> <ul style="list-style-type: none"> <li>The result of conversion is indicated and output in a signal of 4 to 20 mA DC.</li> </ul>
Auto Calibration	<ul style="list-style-type: none"> <li>The gas analyzer is automatically calibrated.</li> <li>Auto calibration cycle settable range: 1 to 99 hours (1-hour step) or 1 to 40 days (1-day step)</li> <li>Auto calibration gas injection time settable range: 60 to 599 seconds (in 1-sec step)</li> <li>Auto/manual calibration error contact output: Provided when calibration quantity exceeds 50% of full scale.</li> <li>Contact output during auto calibration and maintenance: Provided during calibration gas flow and replacement. Also provided during maintenance.</li> <li>Auto calibration remote start contact input: Calibration starts at opening after short-circuit for 1.5 sec or longer.</li> <li>Standard gas consumption: Approx. 1 year with 3.4L cylinder in a calibration cycle of 7 days</li> </ul>
Average Value after O <sub>2</sub> Correction, O <sub>2</sub> average value	<ul style="list-style-type: none"> <li>NO<sub>x</sub>, SO<sub>2</sub> and CO values are averaged after O<sub>2</sub> correction, and the result is indicated and output in 4 to 20 mA DC.</li> <li>Averaging time is settable by key operation at the front of analyzing block. Settable range: 1 to 59 minutes or 1 to 4 hours (factory-set at 1 hour)</li> </ul>
Remote Output Hold	<ul style="list-style-type: none"> <li>The output signal values are collectively held according to external contact input.</li> <li>Output is held during short-circuit.</li> </ul>
Average Value Resetting Input	<ul style="list-style-type: none"> <li>Output and indication of average value after O<sub>2</sub> conversion are reset according to external contact input.</li> <li>Output and indication are reset at short-circuit for 1.5 sec or longer.</li> </ul>
Automatic range changeover	<ul style="list-style-type: none"> <li>Automatically changed from low range to high range, and from high range to low range.</li> <li>Low → High: Changed at 90% point of the low range</li> <li>High → Low: Changed at 80% point of the high range</li> </ul>
Remote range Changeover Input	<ul style="list-style-type: none"> <li>Low or high range is selectable for each sample component via external contact input.</li> <li>High range is selected for open-circuit, and low range for short-circuit.</li> </ul>
Range Identification Contact Output	<ul style="list-style-type: none"> <li>Identification between low and high ranges is output through a contact.</li> <li>When the contact is closed, low range is selected.</li> </ul>
Concentration Alarm Contact Output	<ul style="list-style-type: none"> <li>Instantaneous value alarm is settable for each sample component. High, Low, High or Low is settable (by keys at the front of analyzing block).</li> <li>Contact output hysteresis is also settable.</li> <li>Contact is 1c type.</li> </ul>
CO Instantaneous Value Peak Count Alarm Contact Output	<ul style="list-style-type: none"> <li>Alarm is issued and indicated when CO instantaneous value has exceeded the set limit by the set number of times.</li> <li>Settable number of times: 1 to 99, alarm settable range: 10 to 1000 ppm (5 ppm step)</li> <li>The number of overshootings per hour is indicated.</li> </ul>
Analyzing Block Error Contact Output	<ul style="list-style-type: none"> <li>Contact output is provided when the analyzing block is abnormal.</li> </ul>
Temperature Input Signal	<ul style="list-style-type: none"> <li>K thermocouple input x 2 (for recorder available at option)</li> </ul>

### 3. Performance

- **Repeatability :**  $\pm 0.5\%$  of full scale
- **Zero drift :**  $\pm 1.0\%$  of full scale or lower/week  
( $\pm 2.0\%$  of full scale/week when the range is less than 200 ppm)  
Max.  $\pm 2.0\%$  of full scale/month on O<sub>2</sub> sensor
- **Span drift :** Max.  $\pm 2.0\%$  of full scale/week  
Max.  $\pm 2.0\%$  of full scale/month on O<sub>2</sub> sensor
- **Linearity :** Max.  $\pm 1.0\%$  of full scale
- **Response time :** For 90% indication (after extracting sample gas through the inlet)  
NO<sub>x</sub> : 120 sec or shorter  
SO<sub>2</sub> : 240 sec or shorter  
CO : 120 sec or shorter  
CO<sub>2</sub> : 120 sec or shorter  
O<sub>2</sub> : 120 sec or shorter
- **Sample gas flow rate :**  
Approx. 2L/min

### 4. Standard Requirements for Sample Gas

- **Temperature :** Standard : 60 to 800°C  
Non standard : 1000°C (titanium probe)  
1300°C (SiC probe)
- **Dust :** 100 mg/Nm<sup>3</sup> or less
- **Pressure :** -3k to +3kPa
- **Components :**

SO <sub>2</sub>	500 ppm or less
NO <sub>x</sub>	1000 ppm or less
CO <sub>2</sub>	0 to 15%
CO	2000 ppm or less
O <sub>2</sub>	1 to 21%
HCL	100 ppm or less
The remaining	N <sub>2</sub> , H <sub>2</sub> O

### 5. Installation Requirements

- (1) Selection of a place which does not receive direct sunlight or radiation from hot substances  
If such a place cannot be found, a roof or cover should be prepared for protection.
- (2) Avoidance of a place under heavy vibration
- (3) Selection of a place where atmospheric air is clean

## SCOPE OF DELIVERY

- Gas analyzer system
- Specified external drain separator/drain pot
- Specified gas extractor/probe set
- Specified gas inlet tube set
- Standard accessories

## ITEMS TO BE PREPARED SEPARATELY

1. Standard gas and pressure regulator  
(Refer to ZSY of CODE SYMBOLS)
2. Recorder (when necessary) type PHR
3. Individual inspection of measurement method
4. 1-year spare (Refer to ZBN of CODE SYMBOLS)
5. Waterproof gland for outdoor wiring port (A25A),  
Order No.: 8641625
6. Anchor bolt

## CODE SYMBOLS

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20																			
Z	S	U				5													
Description																			
Measuring gas component <4th digit>																			
P NOx																			
A SO2																			
B CO																			
F NOx,SO2																			
H NOx,CO																			
L NOx,SO2,CO																			
M NOx,SO2,CO,CO2																			
O2 sensor O2 correction value <5th digit>																			
0 Without Without																			
4 Zirconia 4% (Oil fuel)																			
5 Zirconia 5% (Gas fuel)																			
6 Zirconia 6% (Coal fuel)																			
C Zirconia 12% (Refuse incinerator)																			
D Magnetic 4% (Oil fuel)																			
E Magnetic 5% (Gas fuel)																			
F Magnetic 6% (Coal fuel)																			
G Magnetic 12% (Refuse incinerator)																			
NOx measuring range <6th and 7th digit>																			
Select your code in the table at left.																			
SO2 measuring range <9th and 10th digit>																			
Select your code in the table at left.																			
CO measuring range <11th and 12th digit>																			
Select your code in the table at left.																			
O2 measuring range <13th codes>																			
0 Without																			
1 10/ 25%																			
2 25%																			
CO2 measuring range <14th and 15th digit>																			
Y Y Without																			
M N 10%/ 20%																			
M Y 10%/Without																			
N Y 20%/Without																			
Isolated output of analog instantaneous value <16th digit> (Note 1)																			
(Measured component) (Isolation output)																			
Y Each component Without																			
A NOx Isolated																			
B SO2 Isolated																			
C CO Isolated																			
D NOx,SO2 Isolated																			
E NOx,CO Isolated																			
F NOx,SO2,CO Isolated																			
G NOx,SO2,CO,CO2 Isolated																			
H NOx,O2 Isolated																			
J SO2,O2 Isolated																			
K CO,O2 Isolated																			
L NOx,SO2,O2 Isolated																			
M NOx,CO,O2 Isolated																			
N NOx,SO2,CO,O2 Isolated																			
P NOx,SO2,CO,CO2,O2 Isolated																			
O2 correction value isolation output <17th digit> (Note 1)																			
(Measured component) (Isolation output)																			
0 Each component Without																			
1 NOx Isolated																			
2 SO2 Isolated																			
3 CO Isolated																			
4 NOx,SO2 Isolated																			
5 NOx,CO Isolated																			
6 SO2,CO Isolated																			
7 NOx,SO2,CO Isolated																			
Isolated output of average value after O2 correction <18th digit> (Note 1)																			
(Measured component) (Isolation output)																			
0 Each component Without																			
1 NOx Isolated																			
2 SO2 Isolated																			
3 CO Isolated																			
4 NOx,SO2 Isolated																			
5 NOx,CO Isolated																			
6 SO2,CO Isolated																			
7 NOx,SO2,CO Isolated																			
(Sample gas pressure) (External drain separator) <19th digit>																			
1 -1 to +5kPa-----Without																			
2 -3 to +3kPa-----Without																			
3 -5 to +1kPa-----Without																			
4 -1 to +5kPa-----With (Note3)																			
5 -3 to +3kPa-----With (Note3)																			
6 -5 to +1kPa-----With (Note3)																			
Cubicle structure <20th digit>																			
1 Indoor structure																			
2 Outdoor structure																			

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
Z	S	U					5																									

A																																
C																																
D																																
2																																
3																																
A																																
B																																
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K																																
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1																																
2																																
3																																


Note 2) The contents to be recorded with a 6-point recorder are assigned and connected as specified in the above table for its delivery.

Recorder type PHR

\* If other contents are desired, customer must specify them separately.

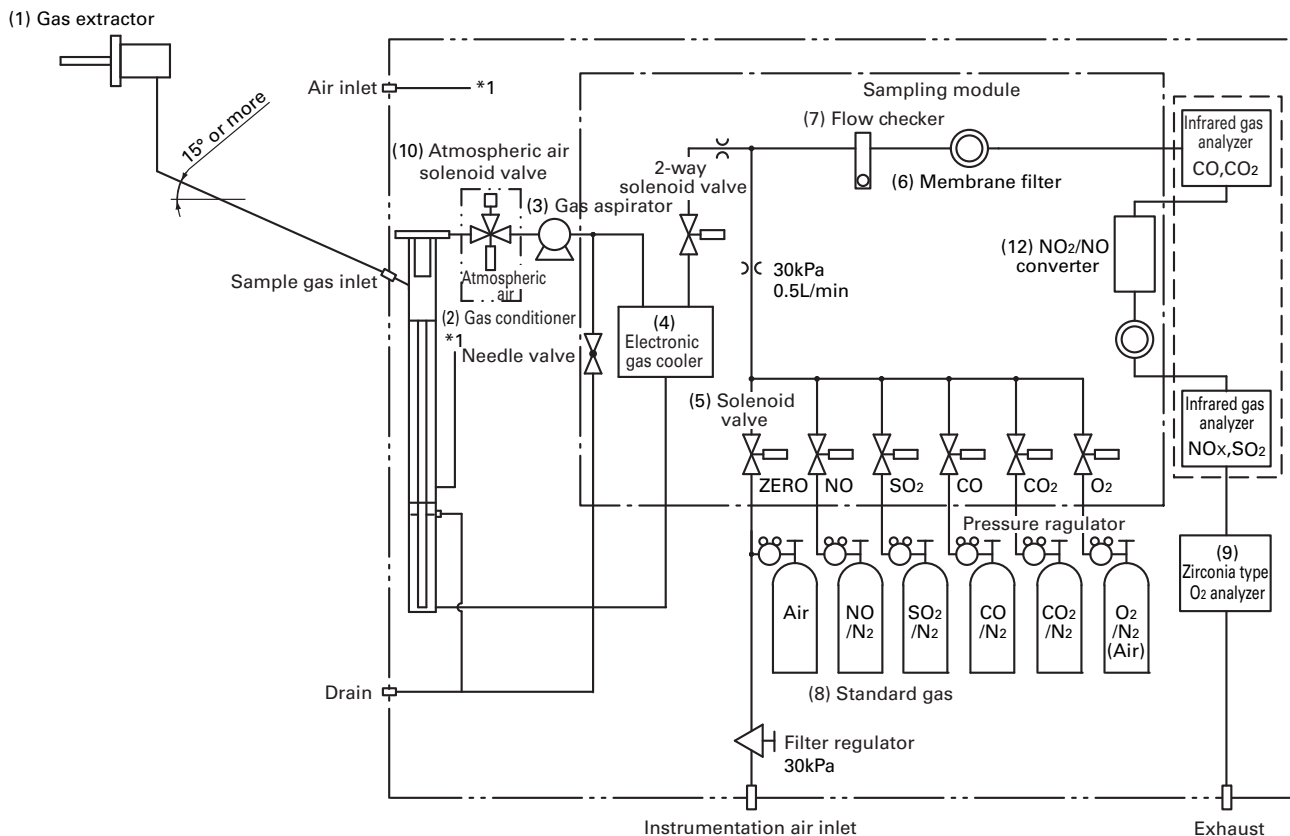
Note 3) Specify this code when the downward inclination of the sample inlet tube from the gas extraction point to the analyzer gas inlet is less than 15° or when moisture content of the sample gas is higher than 30%.

Note 4) Specify code 3 when Measure Act and/or CO<sub>2</sub> meter is selected.





## 5-Component Gas Sampling System Diagram 1 (Standard type with SO<sub>2</sub> first range of less than 500ppm)

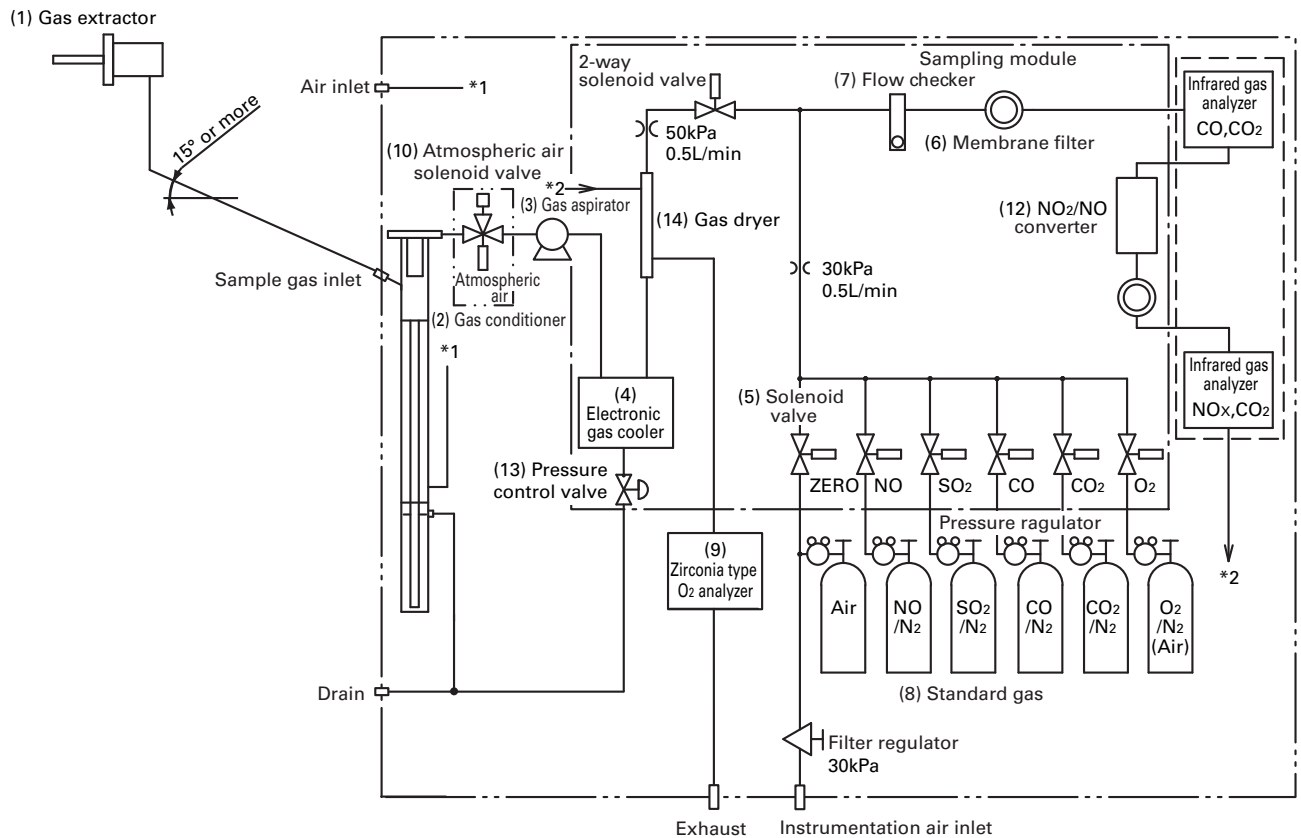


### Functions of Individual Components

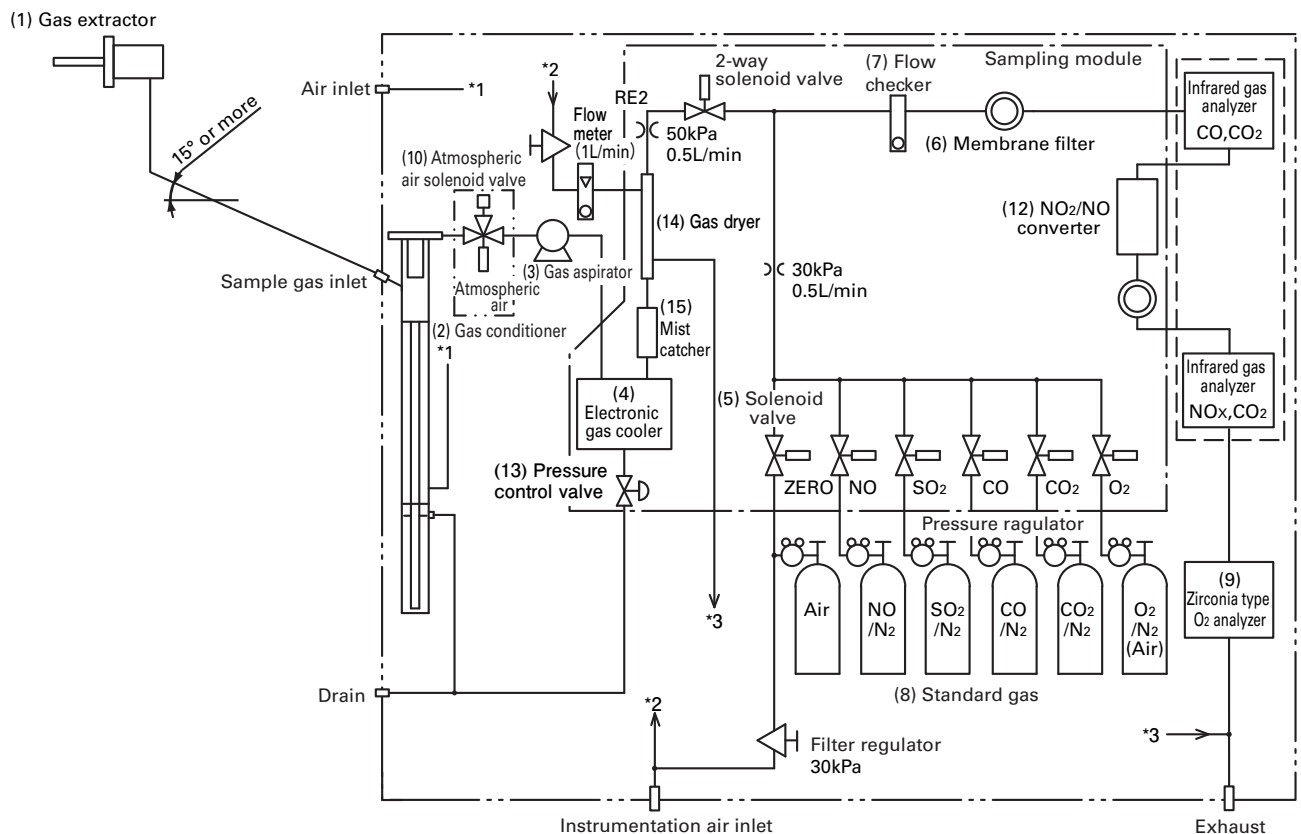
- (1) **Gas extractor:** Gas extraction, with heating type stainless steel filter having a standard diameter of 40μm
- (2) **Gas conditioner:** Removes drain, mist and dust, and monitors the gas pressure.
- (3) **Gas aspirator:** Aspirates sample gas (Flow rate of sample gas: Approx. 2L/min)
- (4) **Electronic gas cooler:** Dries the moisture in the sample gas.
- (5) **Solenoid valve:** Used for introducing calibration gas.
- (6) **Membrane filter:** PTFE filter, glassfiber filter used to eliminate fine dust particles and permit monitoring of dust adhering condition on the gas analyzer.
- (7) **Flow checker:** Monitors the sample gas flow rate (it can be controlled by the separate needle valve.)
- (8) **Standard gas:** Reference gas used for calibrating zero and span of the analyzer. Up to 6 gases (Zero gas air, span gas NO<sub>x</sub>, SO<sub>2</sub>, CO, CO<sub>2</sub> and O<sub>2</sub>) can be used.
- (9) **O<sub>2</sub> sensor:** Used for measuring the oxygen concentration (0 to 25%) in sample gas.
- (10) **Atmospheric air solenoid valve:** Can be built in for using the atmospheric air instead of standard air.
- (11) **Switching box:** 7 power ON-OFF switches of the following equipments are built in.
- Gas extractor
  - Gas aspirator
  - Fluorescent lamp and service outlet (Max. 2A)
  - Sampling module
  - O<sub>2</sub> sensor
  - Heater for the gas conditioner
  - Ventilator
- (12) **Converter:** Added to NO<sub>x</sub> analyzer. A special catalyst material for efficient conversion of NO<sub>2</sub> gas to NO is used.
- (13) **Pressure control valve:** Pressure adjustor to keep the sample gas pressure at a fixed level.
- (14) **Gas dryer:** Semi-permeable membrane type dehumidifier to dry the moisture in the sample gas to dew point -15°C or less.
- (15) **Mist catcher:** Removes sulfate mist in the sample gas. Replaced every 4 months when SO<sub>3</sub> concentration value is 30ppm. Added when SO<sub>2</sub> value is more than 0 to 500ppm or when oil/coal boiler is used.

## 5-Component Gas Sampling System Diagram 2

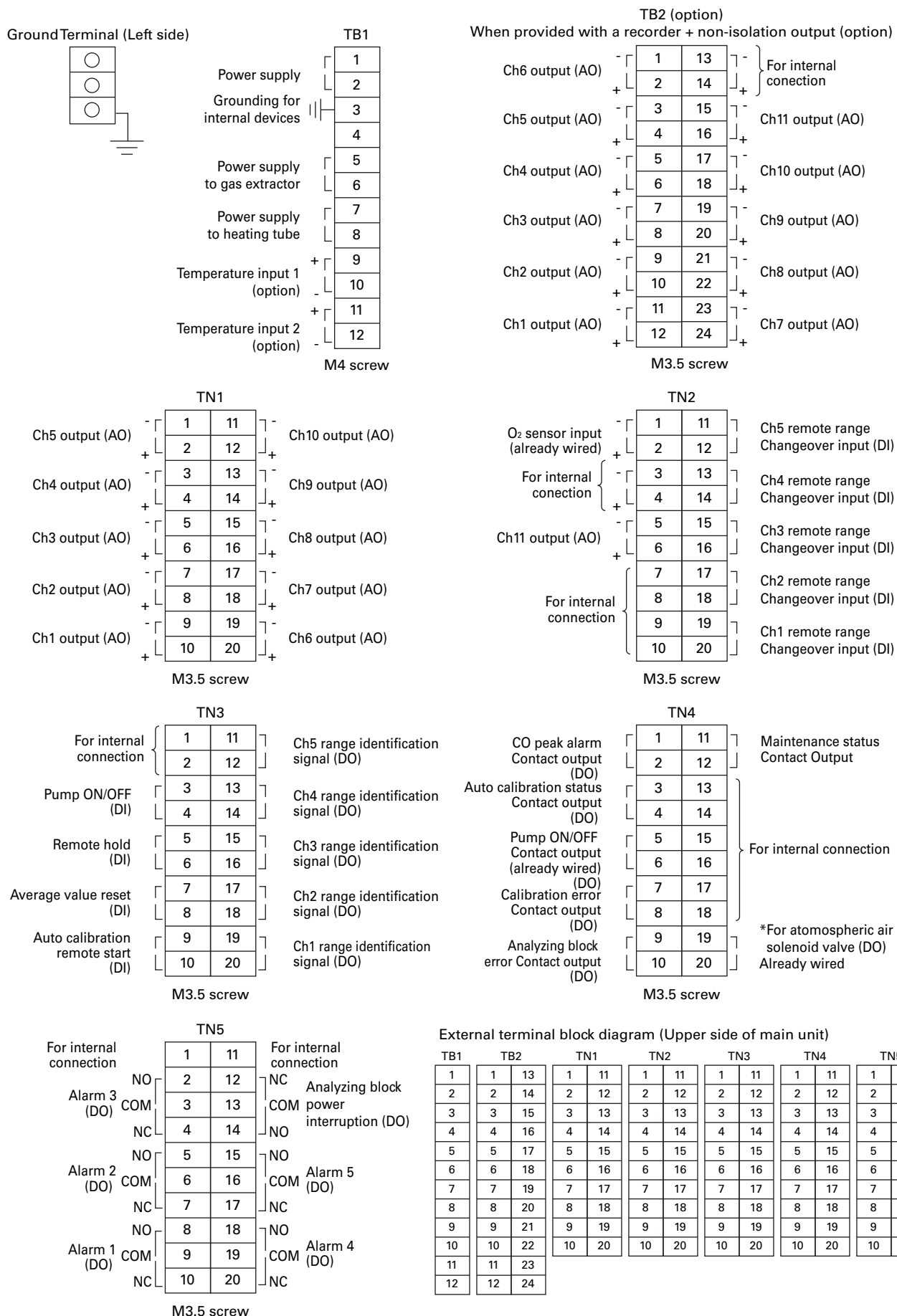
(Gas boiler or sludge incineration with SO<sub>2</sub> first range of less than 500ppm)



## 5-Component Gas Sampling System Diagram 3 (SO<sub>2</sub> first range of 500ppm or higher or oil/coal boiler)



## External Terminal Connection Diagram



Note) NO; normal open contact, NC; normal close contact

## Contents of Measured Channel (CH)

The following table gives the contents of each output signal according to code symbols.

Code symbol		Contents
4th digit	5th digit	
P	0	Ch1: NO <sub>x</sub>
A	0	Ch1: SO <sub>2</sub>
B	0	Ch1: CO
F	0	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub>
H	0	Ch1: NO <sub>x</sub> , Ch2: CO
L	0	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO
M	0	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO <sub>2</sub> , Ch4: CO
P	4 to G	Ch1: NO <sub>x</sub> , Ch2: O <sub>2</sub> , Ch3: Corrected NO <sub>x</sub> , Ch4: Corrected NO <sub>x</sub> average
A	4 to G	Ch1: SO <sub>2</sub> , Ch2: O <sub>2</sub> , Ch3: Corrected SO <sub>2</sub> , Ch4: Corrected SO <sub>2</sub> average
B	4 to G	Ch1: CO, Ch2: O <sub>2</sub> , Ch3: Corrected CO, Ch4: Corrected CO average
F	4 to G	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: O <sub>2</sub> , Ch4: Corrected NO <sub>x</sub> , Ch5: Corrected SO <sub>2</sub> , Ch6: Corrected NO <sub>x</sub> average, Ch7: Corrected SO <sub>2</sub> average
H	4 to G	Ch1: NO <sub>x</sub> , Ch2: CO, Ch3: O <sub>2</sub> , Ch4: Corrected NO <sub>x</sub> , Ch5: Corrected CO, Ch6: Corrected NO <sub>x</sub> average, Ch7: Corrected CO average
L	4 to G	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO, Ch4: O <sub>2</sub> , Ch5: Corrected NO <sub>x</sub> , Ch6: Corrected SO <sub>2</sub> , Ch7: Corrected CO, Ch8: Corrected NO <sub>x</sub> average, Ch9: Corrected SO <sub>2</sub> average, Ch10: Corrected CO average
M	4 to G	Ch1: NO <sub>x</sub> , Ch2: SO <sub>2</sub> , Ch3: CO <sub>2</sub> , Ch4: CO, Ch5: O <sub>2</sub> , Ch6: Corrected NO <sub>x</sub> , Ch7: Corrected SO <sub>2</sub> , Ch8: Corrected CO, Ch9: Corrected NO <sub>x</sub> average, Ch10: Corrected SO <sub>2</sub> average, Ch11: Corrected CO average

## Standard Accessories

No.	Name	Quantity	Remarks
1	Filter paper for membrane filter/as spare (Teflon)	4 pair	When SO <sub>2</sub> meter is provided
	Filter paper for membrane filter (pack of 25)/as spare (glass fiber)	1 box	
2	Fuse (2A)/as spare	1 fuses	When SO <sub>2</sub> meter is not provided
3	Fuse (3.2A)/as spare	1 fuses	
4	Standard gas joint R1/4 - $\phi$ 6mm	1 set	
5	Hose band for fixing standard gas cylinder	1 set	
6	Toaron tube for standard gas connection, 1 m and $\phi$ 9 / $\phi$ 5mm	1 tube	
7	Polyethylene tube for standard gas connection, 6 m and $\phi$ 6 / $\phi$ 4mm	1 tube	
8	Anchor bolt for cubicle installation, (Option) M12 $\times$ 160 $\times$ 50	4	
9	Water bottle for injection	1	} When gas extractor is equipped
10	Gas sampling pipe flange packing	1	
11	Gas extractor fastening bolt and nut (M12 $\times$ 60mm)	1 set	
12	Heating tube support	1 set	When heating tube is equipped
13	Instruction manual (INZ-TN5ZSU-E)	1 copy	For CO <sub>2</sub> measurement
14	Cell assembling tool	1	

## Spare Parts for 1-Year Measurement

- 1 pairs of or 4 pack of filter paper for membrane filter (Note 1)
- Membrane filter O-ring (G65) ×2
- Membrane filter rubber-ring ×2
- Filter element for conditioner filter ×2
- O-ring (G65) for conditioner filter ×2
- Diaphragm for gas aspirator ×1
- Valve for gas aspirator ×1
- Fuse (2A) ×4
- Fuse (3.2A) ×3
- Capillary for 50kPa/0.5L ×1

.....When SO<sub>2</sub> first range is from 0 to 500 ppm or higher  
 Not provided for gas boiler, sludge incineration, and  
 oil/coal boiler

- O-ring for gas extractor (G50) ×1
- Packing for gas extractor wire mesh filter ×1
- Wire mesh filter packing for gas extraction ×1
- O-ring (G45) for gas extraction ×1
- NO<sub>x</sub>/NO converter catalyst ×1
- Glass wool for NO<sub>2</sub>/NO converter
- Fitting for NO<sub>2</sub>/NO converter ×2
- Mist catcher ×3

} Added when gas  
extractor is equipped

} Added when NO<sub>x</sub>  
analyzer is equipped

.....SO<sub>2</sub> first range of 500 ppm or higher or oil/coal boiler

(Note 1) 1 pairs for SO<sub>2</sub> analyzer, on 1 pack (25sheets) for  
 other

## Code Symbols for Spare Parts for 1-Year Measurement

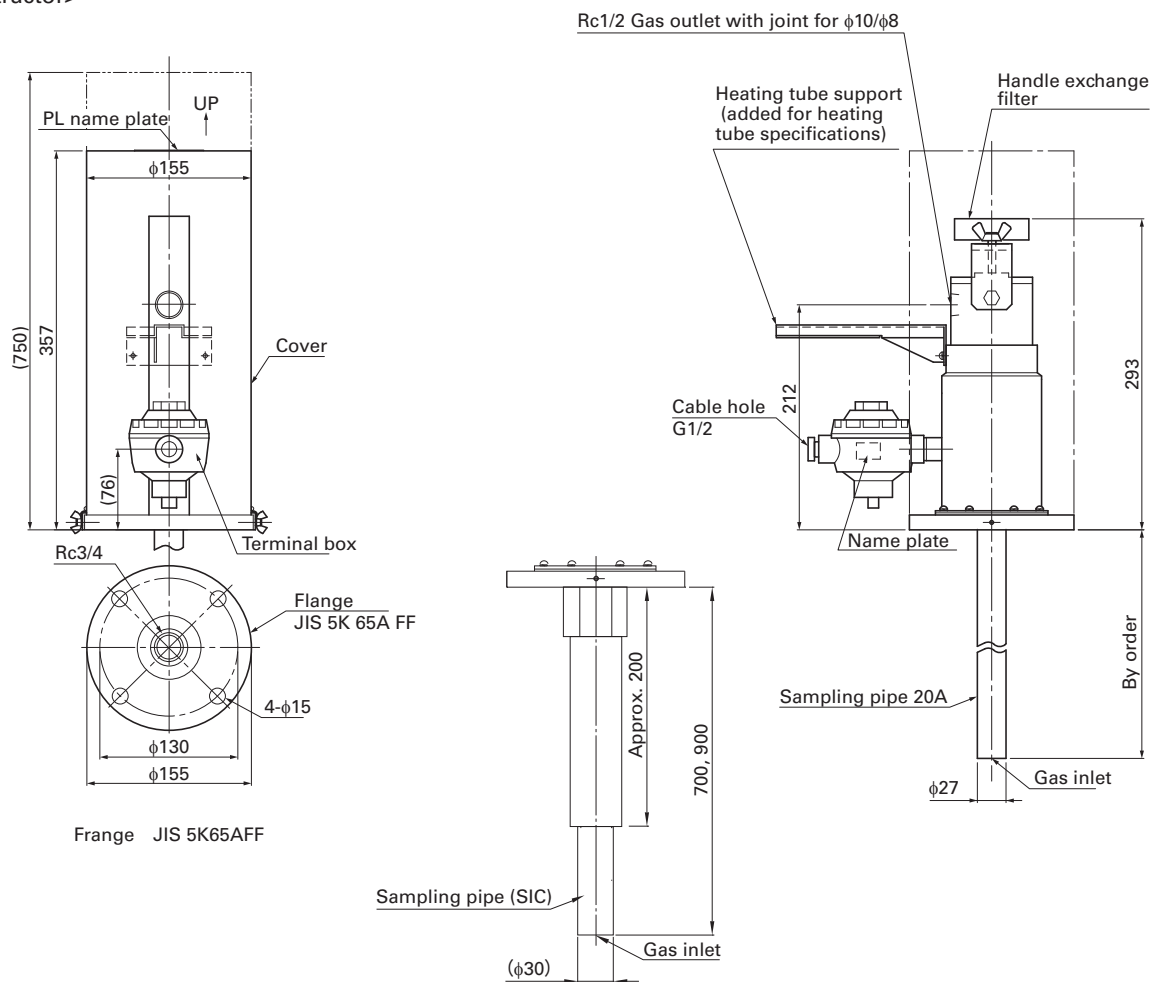
1	2	3	4	5	6	7	8	
Z	B	N	4	S			2	Description
					U			(Application)
					1			Refuse incinerator, Gas boiler
								Oil/coal boiler
								(Gas extractor) (NO <sub>x</sub> analyzer) (SO <sub>2</sub> analyzer)
					0			Without Without Without
					1			With Without Without
					2			Without With Without
					3			With With Without
					A			Without Without With (Less than 500 ppm)
					B			With Without With (Less than 500 ppm)
					C			Without With With (Less than 500 ppm)
					D			With With With (Less than 500 ppm)
					E			Without Without With (500 ppm or higher)
					F			With Without With (500 ppm or higher)
					G			Without With With (500 ppm or higher)
					H			With With With (500 ppm or higher)

1	2	3	4	5	6	7	8	9	10	11	
Z	S	Y					2	-			Description
0											NO <sub>x</sub> measurement first range <4th digit>,ppm
A											Without
1											50
2											100
3											200
4											250
5											500
6											1000
7											2000
											5000
0											SO <sub>2</sub> measurement first range <5th digit>,ppm
A											Without
1											50
2											100
3											200
4											250
5											500
6											1000
7											2000
											5000
0											CO measurement first range <6th digit>,ppm
A											Without
1											50
2											100
3											200
4											250
5											500
6											1000
7											2000
											5000
Y											CO <sub>2</sub> measurement first range <7th digit>,ppm
A											Without
B											5
C											10
											20
0											O <sub>2</sub> span gas <9th digit>
1											Without
2											1.8 to 2% O <sub>2</sub> / N <sub>2</sub>
3											10% O <sub>2</sub> / N <sub>2</sub>
											AIR
Y											Zero gas <10th digit>
A											Without
B											Air cylinder (without certificate)
C											Air cylinder (with certificate Japanese official organization)
D											N <sub>2</sub> cylinder (without certificate)
											N <sub>2</sub> cylinder (with certificate)
Y											Official certificate <11th digit>
A											Without
B											NO <sub>x</sub>
C											SO <sub>2</sub>
D											CO
E											NO <sub>x</sub> , SO <sub>2</sub>
F											NO <sub>x</sub> , CO
G											NO <sub>x</sub> , SO <sub>2</sub> , CO
H											NO <sub>x</sub> , O <sub>2</sub>
J											SO <sub>2</sub> , O <sub>2</sub>
K											CO, O <sub>2</sub>
L											NO <sub>x</sub> , SO <sub>2</sub> , O <sub>2</sub>
M											NO <sub>x</sub> , CO, O <sub>2</sub>
											NO <sub>x</sub> , SO <sub>2</sub> , CO, O <sub>2</sub>

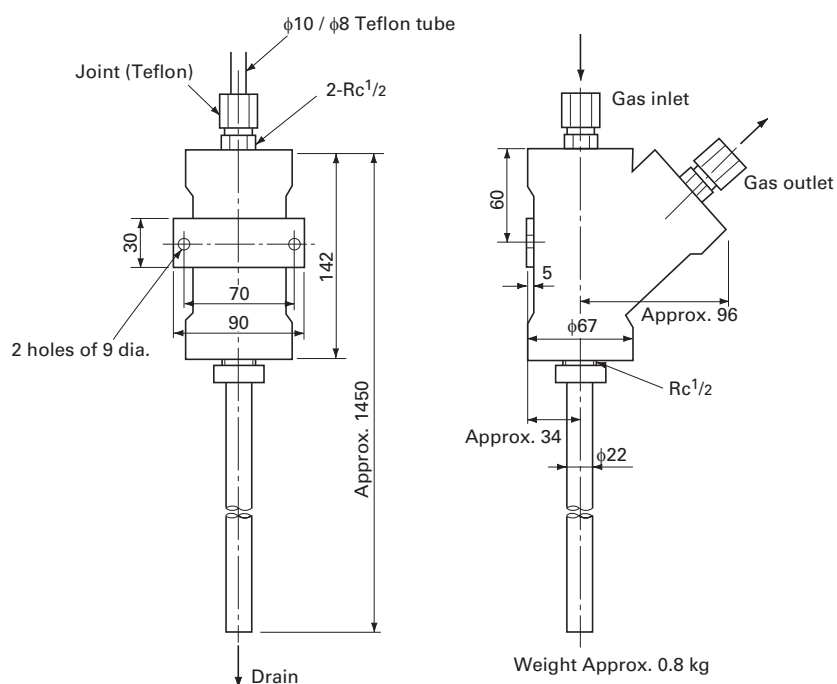
Scope of Delivery: standard gas (3.4L) with pressure regulator

# OUTLINE DIAGRAM (Unit: mm)

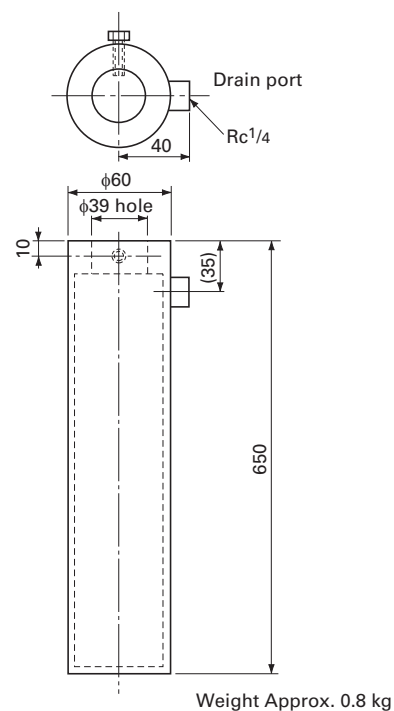
<Gas extractor>



<Drain separator>



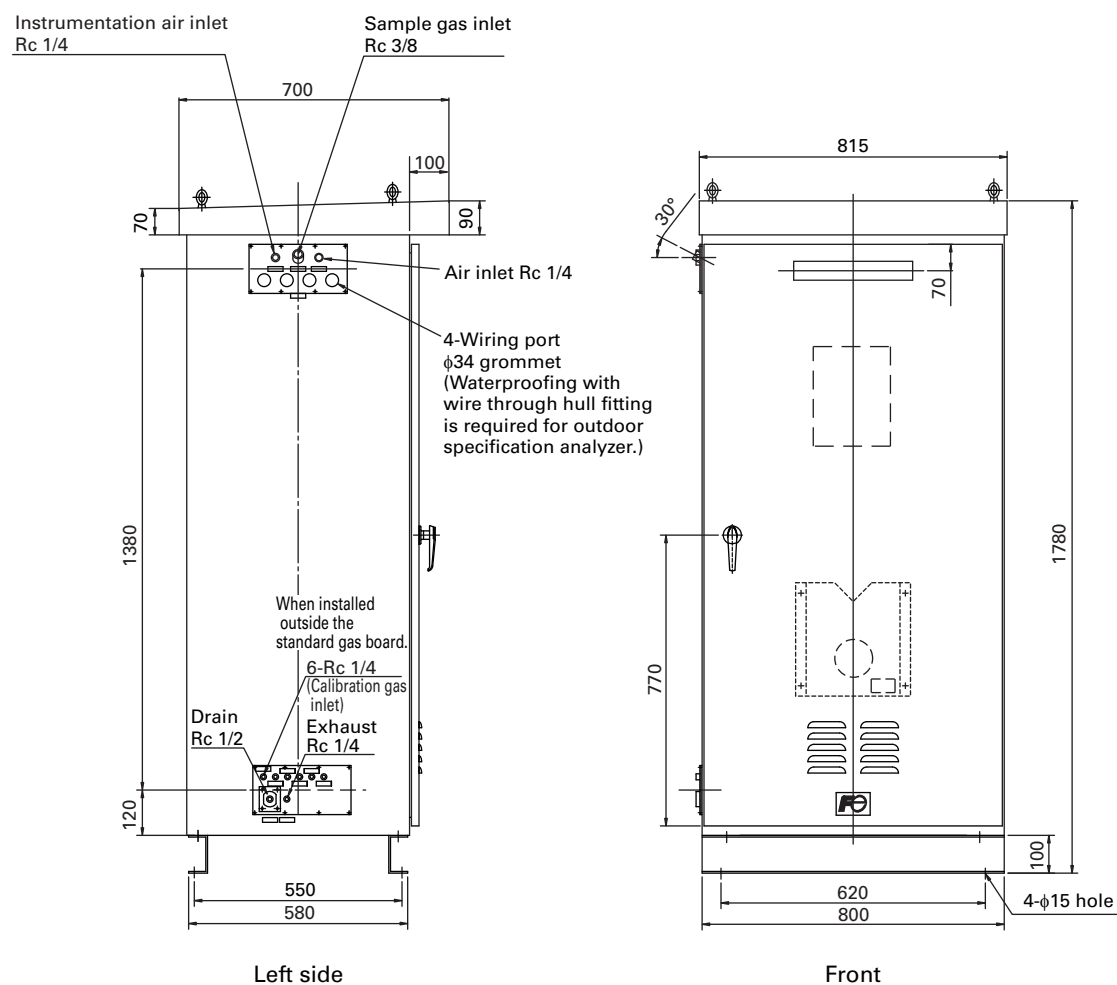
<Drain pot>



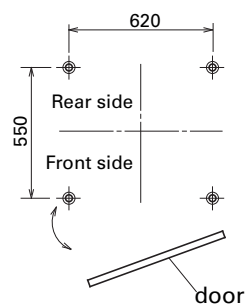


## OUTLINE DIAGRAM (Unit: mm)

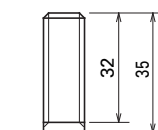
<Outdoor type>



Anchor plan, door open/close diagram

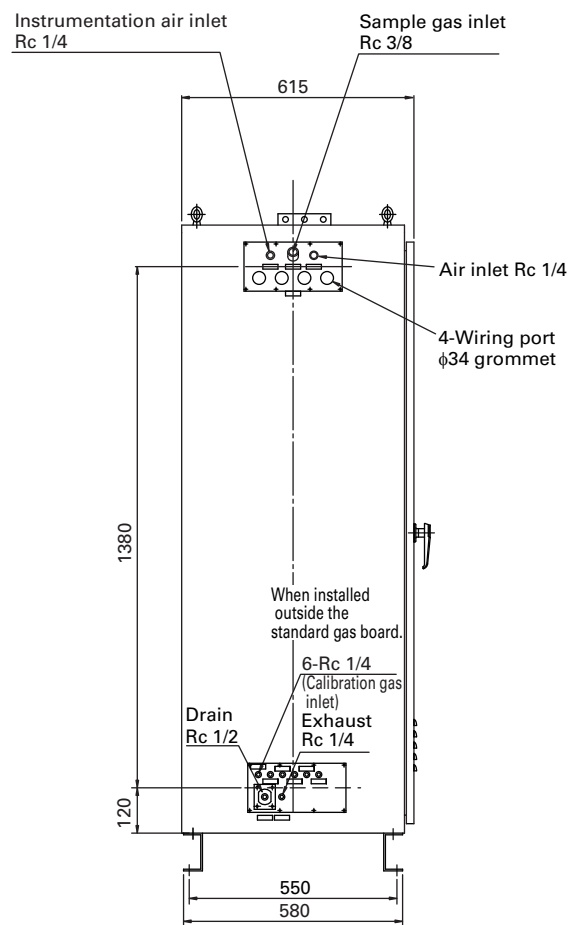


Anchor bolt (option)  
(4-M12  $\times$  160  $\times$  50)

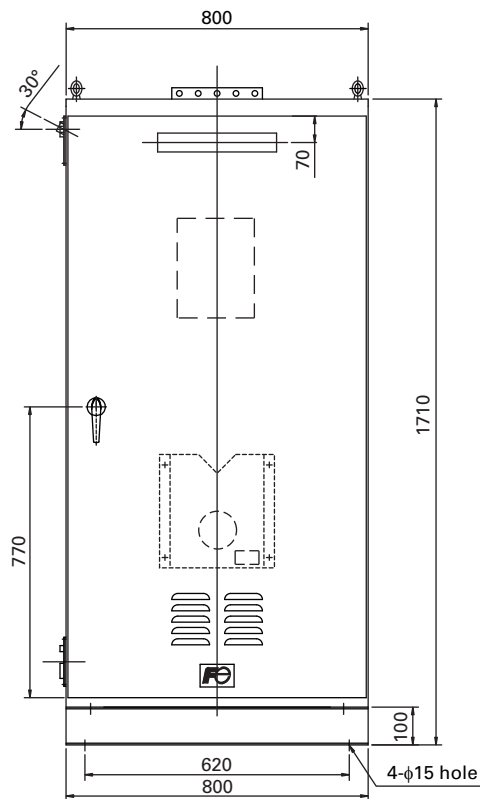


## OUTLINE DIAGRAM (Unit: mm)

<Indoor type>

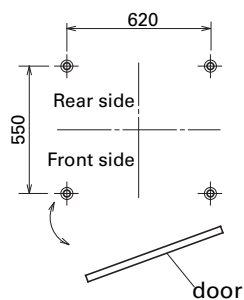


Left side

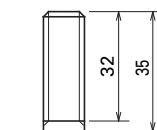


Front

Anchor plan, door open/close diagram



Anchor bolt (option)  
(4-M12 × 160 × 50)



⚠ Caution on Safety

\*Before using this product, be sure to read its instruction manual in advance.

**F** Fuji Electric Co., Ltd.

**Global Sales Section**  
**Instrumentation & Sensors Planning Dept.**  
 1, Fuji-machi, Hino-city, Tokyo 191-8502, Japan  
<http://www.fujielectric.com>  
 Phone: +81-42-514-8930 Fax: +81-42-583-8275  
<http://www.fujielectric.com/products/instruments/>

## ANEXO C

- INFORME MONITOREO ALGORITMO

## **CAMPAÑA DE MONITOREO DE CALIDAD DE AIRE, LOCALIDAD CALAMA ENAEX CALAMA**

*Preparado por:*



*Para:*



Febrero, 2018

## INFORME RESULTADOS FEBRERO 2018 MCA 030-18

### CAMPAÑA DE MONITOREO DE CALIDAD DE AIRE, LOCALIDAD CALAMA ENAEX CALAMA

Preparado para:



Versión del Documento				1	
Responsable Elaboración		Responsable Revisión		Responsable Aprobación	
Nombre:	Gabriela Toro	Nombre:	Marcela Arenas	Nombre:	Aníbal Pacheco
Cargo:	Ingeniero de Proyecto	Cargo:	Encargado de Proyecto	Cargo:	Gerente Técnico
Fecha:	19-02-2018	Fecha:	20-02-2018	Fecha:	20-02-2018
Firma:		Firma:		Firma:	

Febrero, 2018

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## 1. RESUMEN

El presente informe entrega los resultados obtenidos a partir del muestreo de la variable NO<sub>x</sub> realizado en los alrededores de la localidad de Calama durante los días 18 y 19 del mes de febrero de 2018.

A continuación en la Tabla N° 1 se presenta un resumen de los resultados obtenidos en la campaña de monitoreo de calidad del aire en los 4 puntos donde se realizó la medición.

**Tabla N° 1**  
**Resumen NO, NO<sub>2</sub> y NO<sub>x</sub>**  
**SKC, Condominio, Casino y centro deportivo**

<i>Punto de medición</i>	<i>Estadístico</i>	<i>NO</i>	<i>NO<sub>2</sub></i>	<i>NO<sub>x</sub></i>	<i>Unidades</i>
<b>SKC</b>	Promedio horario	2,6	0,3	4,2	µg/m <sup>3</sup> N
	Mínimo Promedio horario	1,2	0,1	2,1	
	Máximo Promedio horario	5,4	0,6	8,9	
<b>Condominio</b>	Promedio horario	4,8	4,3	11,7	µg/m <sup>3</sup> N
	Mínimo Promedio horario	0,8	1,0	2,5	
	Máximo Promedio horario	11,1	9,6	26,7	
<b>Casino</b>	Promedio horario	20,4	41,4	72,6	µg/m <sup>3</sup> N
	Mínimo Promedio horario	12,1	11,0	33,8	
	Máximo Promedio horario	41,9	88,3	152,6	
<b>Centro deportivo</b>	Promedio horario	1,3	3,5	5,5	µg/m <sup>3</sup> N
	Mínimo Promedio horario	0,4	0,6	1,2	
	Máximo Promedio horario	2,0	5,2	8,3	

Al comparar los valores horarios medidos de NO<sub>2</sub> en las estaciones SKC, Condominio, Casino y centro deportivo con la normativa aplicable, se podría concluir que la concentración horaria no sobrepasa el valor límite establecido por la norma respectiva.

Cabe señalar que esta comparación es solo referencial debido a que la normativa señala que se debe contar con tres años calendarios consecutivos de concentraciones para realizar verificación.



## 2. Introducción

La empresa Enaex S.A. solicitó a Algoritmos y mediciones ambientales SpA realizar un monitoreo de calidad del aire en la ciudad de Calama. Esta medición fue efectuada en respuesta a una solicitud realizada en una reunión de Asistencia al Cumplimiento que Planta Enaex S.A sostuvo con la Superintendencia de Medio Ambiente, donde se acogió a una autodenuncia realizada por una instalación que se ubica en Planta Río Loa de Calama.

A través de este documento se cumple con lo comprometido con la autoridad realizando la medición de concentraciones de calidad del aire de NOx en zonas colindantes a la planta

En la Localidad de Calama se realiza mediciones a través de un laboratorio móvil el cual cuenta con el equipamiento requerido para realizar el monitoreo de NO-NO2-NOx, el cual consistió en mediciones en cuatro puntos denominados SKC, Condominio, Casino y Centro deportivo.

Cabe señalar que el analizador de NOx cumple con las exigencias definidas por la agencia ambiental *USEPA (Environmental Protection Agency)* para este tipo de equipos, el analizador se encuentra instalado al interior de un vehículo adaptado con las condiciones requeridas para realizar monitoreo de calidad del aire.

El presente documento informa los resultados obtenidos durante las mediciones realizadas los días 18 y 19 de Febrero de 2018.

### 3. Objetivos

El objetivo del presente informe es entregar los resultados del Monitoreo de calidad de aire realizado en los puntos de muestreo denominados "SKC", "Condominio", "Casino" y "Centro deportivo" en la ciudad de Calama durante los días 18 y 19 de febrero de 2018.

## 4. Materiales y Metodología

### 4.1. Descripción del área de estudio

Los puntos de monitoreo de calidad del aire fueron definidos por Enaex y corresponden a lugares representativos de los alrededores de la planta Enaex Calama, encontrándose libre de elementos naturales y artificiales que puedan alterar las concentraciones de las mediciones en la zona.

### 4.2. Ubicación del área de estudio

En la Tabla N° 2 se presentan las coordenadas<sup>a</sup> de los puntos de monitoreo SKC, Condominio, Casino y Centro deportivo.

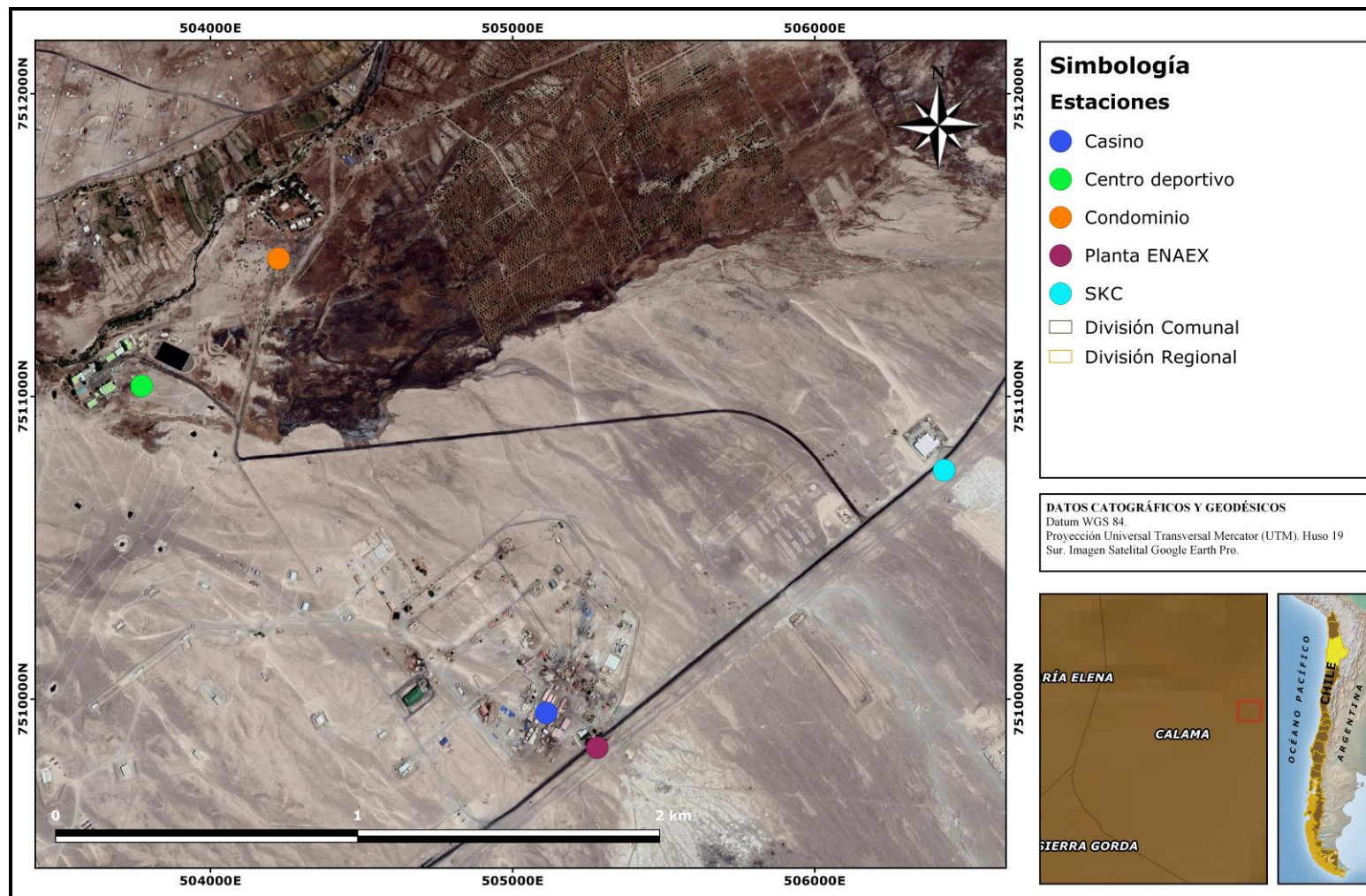
**Tabla N° 2**  
**Identificación de puntos monitoreados**

<b>Estación</b>	<b>Coordenadas UTM</b>	
	<b>Norte</b>	<b>Este</b>
<b>SKC</b>	7.510.756	506.428
<b>Condominio</b>	7.511.455	504.225
<b>Casino</b>	7.509.954	505.111
<b>Centro deportivo</b>	7.511.034	503.772

A continuación, la Figura N° 1 presenta la ubicación espacial de los puntos de monitoreo SKC, Condominio, Casino y centro deportivo.

<sup>a</sup> Coordenadas utilizando como referente Datum: WGS84, Huso 19-K.

**Figura N° 1**  
**Ubicación Espacial de las Estaciones de Monitoreo**



### 4.3. Materiales y Equipos Utilizados

El monitoreo se realizó usando un analizador continuo instalado en un laboratorio móvil. Este último es de material sólido y resistente a las condiciones climáticas imperantes en la zona.

Así mismo el laboratorio móvil cuenta con un equipo de aire acondicionado para mantener las condiciones de temperatura estables al interior del vehículo.

Cabe señalar que antes de comenzar la medición en cada uno de los puntos se realizó un chequeo y calibración (en caso de ser necesario) al analizador asegurando con esto la calidad de la medición realizada, adicionalmente se realiza este mismo procedimiento al finalizar el muestreo en cada uno de los puntos.

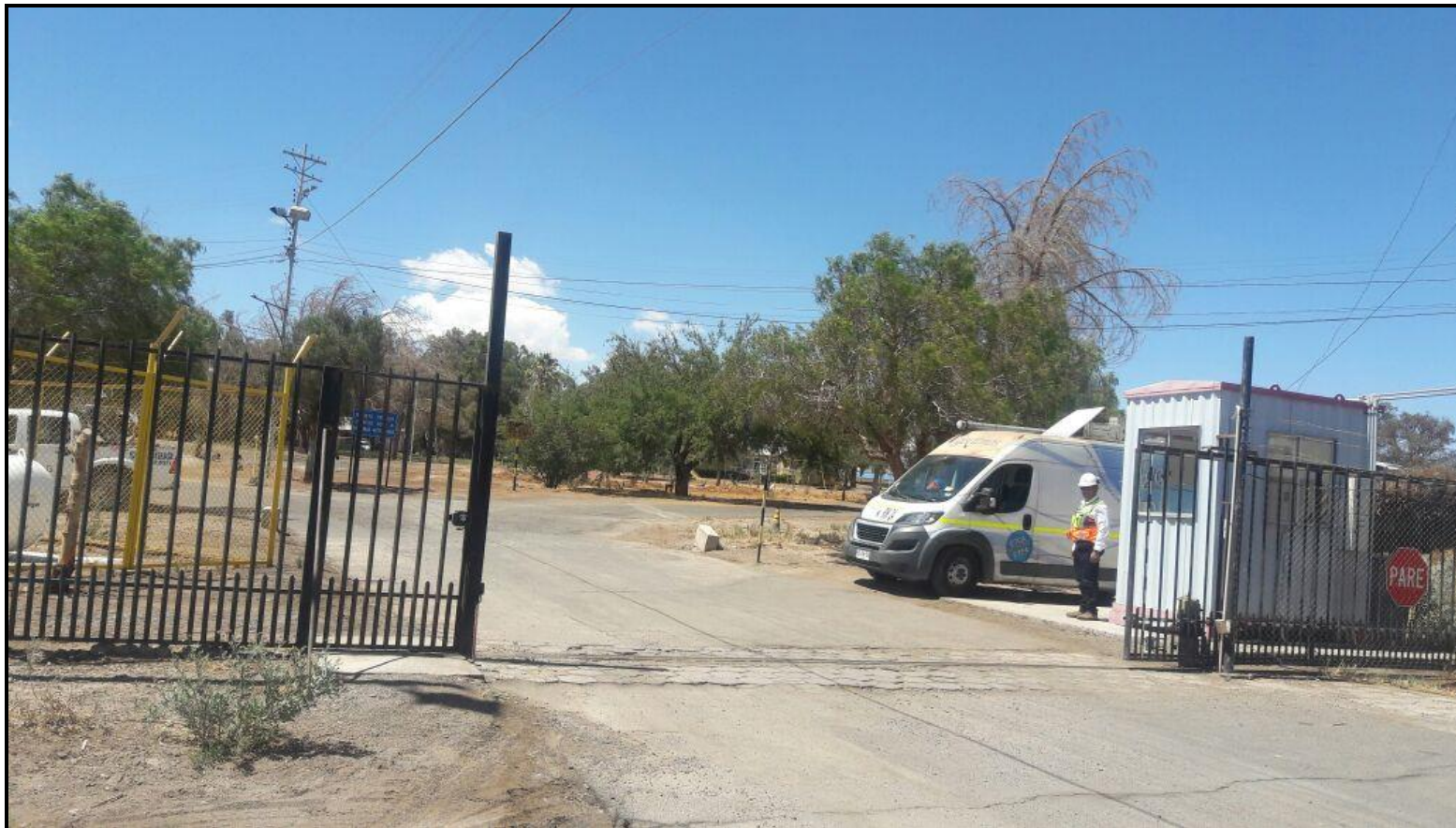
A continuación en la Fotografía N° 1, Fotografía N° 2, Fotografía N° 3 y Fotografía N° 4 se puede observar el laboratorio móvil presente en los puntos de medición SKC, Condominio, Casino y centro deportivo respectivamente.



**Fotografía N° 1**  
**Primer punto SKC**



**Fotografía N° 2**  
**Segundo punto Condominio**





**Fotografía N° 3**  
**Tercer punto Casino**





**Fotografía N° 4**  
**Cuarto punto centro deportivo**



#### **4.4. Metodología de medición y control de muestreo**

La metodología de medición para el contaminante monitoreado se detalla a continuación.

##### **Dióxido de Azufre SO<sub>2</sub>**

El monitoreo de NO/NO<sub>2</sub>/NO<sub>x</sub> se realiza con un analizador continuo el cual utiliza el principio de la quimioluminescencia, donde la luz proyectada hace reaccionar las partículas para luego ser detectadas a través de la cámara del equipo, esto en conjunto con la electrónica de última generación para permitir mediciones precisas y confiables de bajo nivel para su uso como analizador ambiental.

#### **4.5. Parámetros utilizados para caracterizar el estado y evolución de las variables ambientales.**

##### **Decreto Supremo N°114 del Ministerio Secretaría General de la Presidencia de la Republica. Norma de Calidad Primaria de Aire para NO<sub>2</sub>**

El Decreto establece los valores para establecer la condición de superación de la norma primaria de dióxido de nitrógeno, la primera como concentración anual y la segunda como concentración de una hora.

La norma primaria como concentración anual es de 100  $\mu\text{g}/\text{m}^3\text{N}$ , y se considerará superada cuando el promedio aritmético de los valores de concentración anual de tres años calendarios sucesivos sea superior al valor indicado.

La norma primaria como concentración de 1 hora es de 400  $\mu\text{g}/\text{m}^3\text{N}$ , y se considerará superada cuando el promedio aritmético de tres años calendarios sucesivos del valor del Percentil 99 de los máximos diarios de concentración de una hora registrado para cada año, sea superior al valor indicado.

## 4.6 Equipamiento de la estación de monitoreo

A continuación, en la Tabla N° 3 se describe el equipamiento utilizado en las estaciones SKC, Condominio, Casino y Centro deportivo con respecto a los contaminantes monitoreados.

**Tabla N° 3**  
**Analizador de puntos de monitoreos**  
**SKC, Condominio, Casino y Centro deportivo**

Analizador	Marca	Modelo	Método EPA de referencia
NO/NO <sub>2</sub> /NO <sub>x</sub>	Teledyne	T200	RFNA-1194-099

## 4.7 Fecha de Monitoreo

El período de muestreo corresponde a dos días, específicamente para el presente informe los días 18 y 19 de Febrero de 2018, comenzando el muestreo a partir de las 16:00 hrs. del día 18 de Febrero de 2018 y finalizando el día 19 de febrero de 2018 a las 14:00 hrs.

En cada uno de los puntos de monitoreo se realizan 6 horas de medición realizando chequeo y/o calibración al comienzo y al final de cada muestreo contando con 4 horas de concentración válida para cada uno de los puntos.

## 5. Resultados

### 5.1. Primer punto SKC

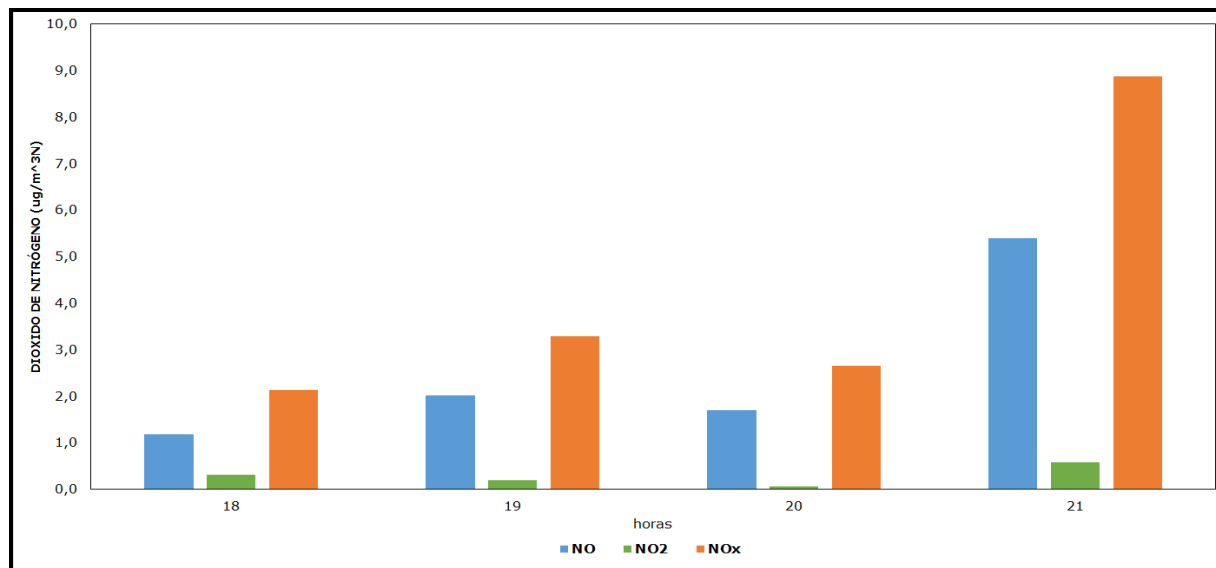
La Tabla N° 4 muestra un resumen de los valores de concentración obtenidos durante el monitoreo realizados para el primer punto de monitoreo SKC.

En el Gráfico N° 1, se muestra el valor horario de las concentraciones de NO-NO<sub>2</sub>-NO<sub>x</sub> registrados durante el período de monitoreo.

**Tabla N° 4**  
**Resumen de NO/NO<sub>2</sub>/NO<sub>x</sub>, SKC**

<i>Estadístico</i>	<i>NO (<math>\mu\text{g}/\text{m}^3\text{N}</math>)</i>	<i>NO<sub>2</sub> (<math>\mu\text{g}/\text{m}^3\text{N}</math>)</i>	<i>NO<sub>x</sub> (<math>\mu\text{g}/\text{m}^3\text{N}</math>)</i>
<b>Promedio horario</b>	2,6	0,3	4,2
<b>Mínimo horario</b>	1,2	0,1	2,1
<b>Máximo horario</b>	5,4	0,6	8,9

**Gráfico N° 1**  
**Concentración de NO/NO<sub>2</sub>/NO<sub>x</sub>, SKC**



## 5.2. Segundo punto Condominio

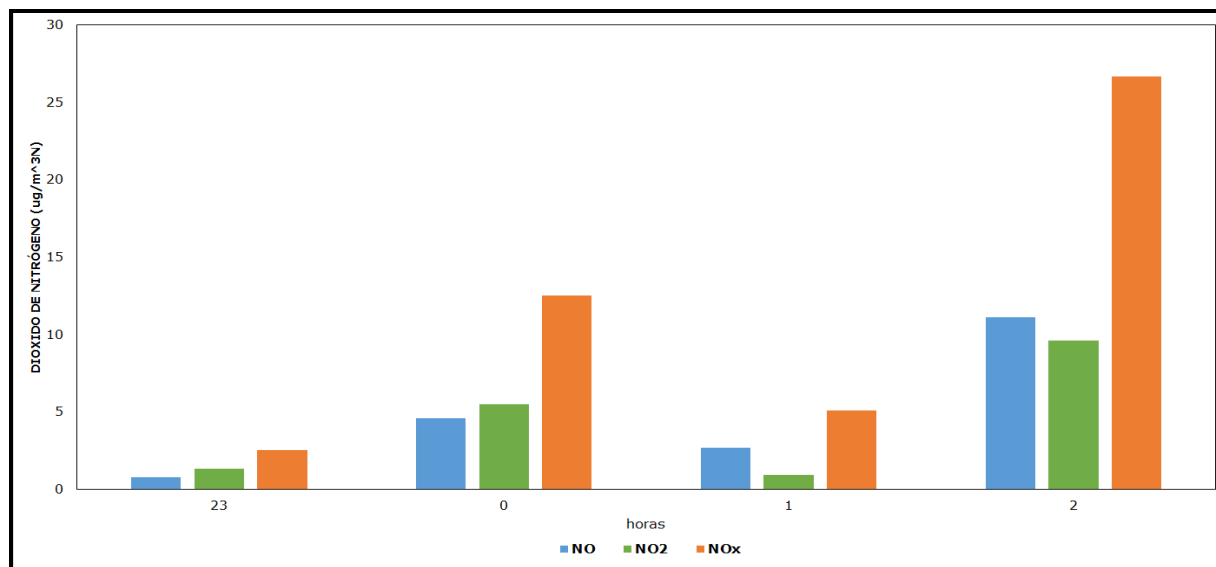
La Tabla Nº 5 se muestra el valor horario de las concentraciones de NO-NO<sub>2</sub>-NO<sub>x</sub> registrados durante el período de monitoreo para el segundo punto Condominio.

En el Gráfico Nº 2, se muestra el valor horario de las concentraciones de NO-NO<sub>2</sub>-NO<sub>x</sub> registrados durante el período de monitoreo

**Tabla Nº 5**  
**Resumen de NO/NO<sub>2</sub>/NO<sub>x</sub>, Condominio**

Estadístico	NO ( $\mu\text{g}/\text{m}^3\text{N}$ )	NO <sub>2</sub> ( $\mu\text{g}/\text{m}^3\text{N}$ )	NO <sub>x</sub> ( $\mu\text{g}/\text{m}^3\text{N}$ )
<b>Promedio horario</b>	4,8	4,3	11,7
<b>Mínimo horario</b>	0,8	1,0	2,5
<b>Máximo horario</b>	11,1	9,6	26,7

**Gráfico Nº 2**  
**Concentración de NO/NO<sub>2</sub>/NO<sub>x</sub>, Condominio**



### 5.3. Tercer Punto Casino

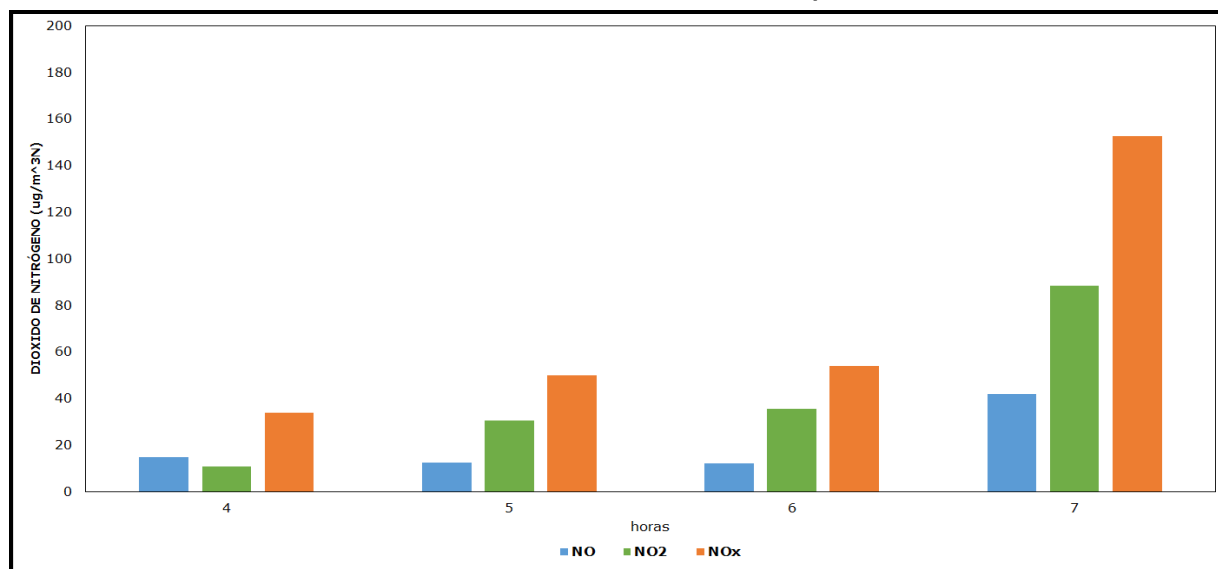
La Tabla N° 6 muestra un resumen de los valores de concentración obtenidos durante el monitoreo realizados en el tercer punto Casino

En el Gráfico N° 3, se muestra el valor horario de las concentraciones de NO-NO<sub>2</sub>-NO<sub>x</sub> registrados durante el período de monitoreo.

**Tabla N° 6**  
**Resumen de NO/NO<sub>2</sub>/NO<sub>x</sub>, Casino**

<i>Estadístico</i>	<i>NO (<math>\mu\text{g}/\text{m}^3\text{N}</math>)</i>	<i>NO<sub>2</sub> (<math>\mu\text{g}/\text{m}^3\text{N}</math>)</i>	<i>NO<sub>x</sub> (<math>\mu\text{g}/\text{m}^3\text{N}</math>)</i>
<b>Promedio horario</b>	20,4	41,4	72,6
<b>Mínimo horario</b>	12,1	11,0	33,8
<b>Máximo horario</b>	41,9	88,3	152,6

**Gráfico N° 3**  
**Concentración de NO/NO<sub>2</sub>/NO<sub>x</sub>, Casino**





## 5.4. Cuarto Punto centro deportivo

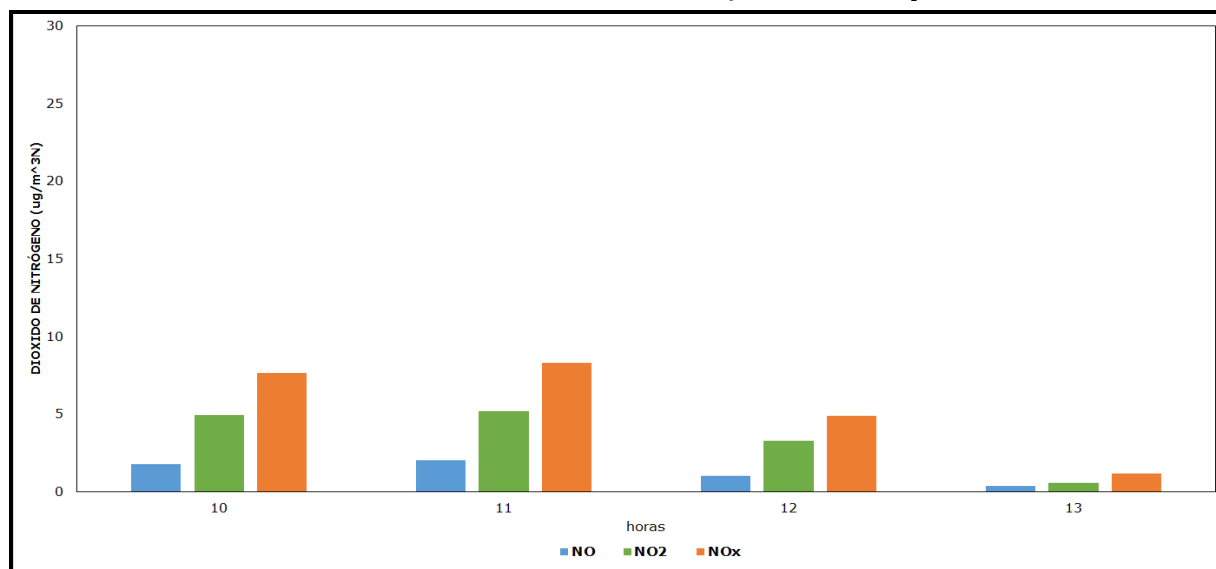
La Tabla N° 7 muestra un resumen de los valores de concentración obtenidos durante el monitoreo realizados para el cuarto punto centro deportivo.

En el Gráfico N° 4 se muestra el valor horario de las concentraciones de NO-NO2-NOx registrados durante el período de monitoreo.

**Tabla N° 7**  
**Resumen de NO/NO2/NOx, Centro deportivo**

<i>Estadístico</i>	<i>NO (<math>\mu\text{g}/\text{m}^3\text{N}</math>)</i>	<i>NO2 (<math>\mu\text{g}/\text{m}^3\text{N}</math>)</i>	<i>NOx (<math>\mu\text{g}/\text{m}^3\text{N}</math>)</i>
<b>Promedio horario</b>	1,3	3,5	5,5
<b>Mínimo horario</b>	0,4	0,6	1,2
<b>Máximo horario</b>	2,0	5,2	8,3

**Gráfico N° 4**  
**Concentración de NO/NO2/NOx, Centro deportivo**



## 6 Conclusiones

### 7.1 Primer punto SKC

- Durante el período de monitoreo correspondiente al 18 de Febrero entre las 16:00 hrs.y 21:00 hrs, no se produce superación de la norma horaria ( $400 \mu\text{g}/\text{m}^3\text{N}$ )<sup>b</sup> en las mediciones de dióxido de nitrógeno ( $\text{NO}_2$ ), siendo el máximo del período monitoreado igual a  $0,6 \mu\text{g}/\text{m}^3\text{N}$ , inferior en un 99,8% del valor límite establecido.
- Cabe señalar que el valor calculado para el período es referencial en comparación a la norma, debido a no contar el período completo requerido (3 años calendario consecutivo)

### 7.2 Segundo punto Condominio

- Durante el período de monitoreo correspondiente al periodo 18 de Febrero desde las 22:00 hrs. al 19 de Febrero a las 03:00 hrs., no se produce superación de la norma horaria ( $400 \mu\text{g}/\text{m}^3\text{N}$ )<sup>b</sup> en las mediciones de dióxido de nitrógeno ( $\text{NO}_2$ ), siendo el máximo del período monitoreado igual a  $9,6 \mu\text{g}/\text{m}^3\text{N}$ , inferior en un 97,6% del valor límite establecido.
- Cabe señalar que el valor calculado para el período es referencial en comparación a la norma, debido a no contar el período completo requerido (3 años calendario consecutivo)

### 7.3 Tercer punto Casino

- Durante el período de monitoreo correspondiente al periodo 19 de Febrero entre las 03:00 hrs.y 08:00 hrs., no se produce superación de la norma horaria ( $400 \mu\text{g}/\text{m}^3\text{N}$ )<sup>b</sup> en las mediciones de dióxido de nitrógeno ( $\text{NO}_2$ ), siendo el máximo del período monitoreado igual a  $88,3 \mu\text{g}/\text{m}^3\text{N}$ , inferior en un 77,9% del valor límite establecido.
- Cabe señalar que el valor calculado para el período es referencial en comparación a la norma, debido a no contar el período completo requerido (3 años calendario consecutivo)

<sup>b</sup> D.S. Nº 114/03, del Ministerio Secretaría General de la Presidencia

## 7.4 Cuarto punto Centro deportivo

- Durante el período de monitoreo correspondiente al periodo 19 de Febrero entre las 09:00 hrs.y 14:00 hrs., no se produce superación de la norma horaria ( $400 \mu\text{g}/\text{m}^3\text{N}$ )<sup>b</sup> en las mediciones de dióxido de nitrógeno ( $\text{NO}_2$ ), siendo el máximo del período monitoreado igual a  $5,2 \mu\text{g}/\text{m}^3\text{N}$ , inferior en un 98,7% del valor límite establecido.
- Cabe señalar que el valor calculado para el período es referencial en comparación a la norma, debido a no contar el período completo requerido (3 años calendario consecutivo)

## 8 Referencias

- CHILE, MINISTERIO SECRETARIA GENERAL DE LA PRESIDENCIA DE LA REPÚBLICA. *Norma de Calidad Primaria de Aire para Dióxido de Nitrogeno (NO<sub>2</sub>)*. D.S.N°114. Santiago 2003.
- EE.UU., Environmental Protection Agency (USEPA).
- EE.UU. Teledyne monitor Labs . Manual de operación Analizador de dióxido de nitrógeno Teledyne Modelo T200 Mayo 2016.

## **ANEXO I NOMENCLATURA PARA INVALIDACIÓN O PÉRDIDA DE DATOS SEGÚN DTO. N° 61**

## CÓDIGOS UTILIZADOS

Código	Significado	Justificación
2.a	Dato inválido	Por falla de energía
2.b	Dato inválido	Por falla de equipo
2.c	Dato inválido	Fuera de rango de temperatura de operación
2.d	Dato inválido	Por cambio de equipo
2.e	Dato inválido	Por mantención en terrero
2.f	Dato inválido	Por tiempo mínimo de muestreo
2.g	Dato inválido	Por exceso de tiempo de muestreo
2.h	Dato inválido	Valor fuera de rango
3.a	Sin dato	Por falla general de equipo
3.b	Sin dato	Por precipitación

## ANEXO II<sup>c</sup> TABLA DE CONCENTRACIÓN DE DIOXIDO DE NITROGENO

---

<sup>c</sup> Los códigos de invalidación están detallados en el ANEXO I.

## Primer punto SKC

### DIOXIDO DE NITROGENO (NO<sub>2</sub>) UNIDAD: µg/m<sup>3</sup>N

	NO	NO <sub>2</sub>	NO <sub>x</sub>
18/02/2018 16:00	2.e	2.e	2.e
18/02/2018 17:00	1,2	0,3	2,1
18/02/2018 18:00	2,0	0,2	3,3
18/02/2018 19:00	1,7	0,1	2,7
18/02/2018 20:00	5,4	0,6	8,9
18/02/2018 21:00	2.e	2.e	2.e



## Segundo punto Condominio

### DIOXIDO DE NITROGENO (NO<sub>2</sub>) UNIDAD: µg/m<sup>3</sup>N

	NO	NO <sub>2</sub>	Nox
18/02/2018 22:00	2.e	2.e	2.e
18/02/2018 23:00	0,8	1,3	2,5
19/02/2018 0:00	4,6	5,5	12,5
19/02/2018 1:00	2,7	1,0	5,1
19/02/2018 2:00	11,1	9,6	26,7
19/02/2018 3:00	2.e	2.e	2.e

## Tercer punto Casino

### DIOXIDO DE NITROGENO (NO<sub>2</sub>) UNIDAD: µg/m<sup>3</sup>N

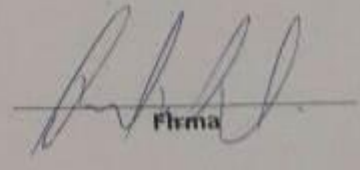
	NO	NO <sub>2</sub>	Nox
19/02/2018 3:00	2.e	2.e	2.e
19/02/2018 4:00	14,9	11,0	33,8
19/02/2018 5:00	12,5	30,6	49,8
19/02/2018 6:00	12,1	35,5	54,1
19/02/2018 7:00	41,9	88,3	152,6
19/02/2018 8:00	2.e	2.e	2.e

## Cuarto punto centro deportivo

### DIOXIDO DE NITROGENO (NO<sub>2</sub>) UNIDAD: µg/m<sup>3</sup>N

	NO	NO <sub>2</sub>	Nox
19/02/2018 9:00	2.e	2.e	2.e
19/02/2018 10:00	1,8	4,9	7,6
19/02/2018 11:00	2,0	5,2	8,3
19/02/2018 12:00	1,0	3,3	4,9
19/02/2018 13:00	0,4	0,6	1,2
19/02/2018 14:00	2.e	2.e	2.e

## **ANEXO III FICHAS DE CALIBRACIÓN, PRIMER PUNTO SKC**

Algoritmos		Ficha de Calibración Analizador de NO <sub>x</sub> -NO <sub>2</sub> -NO		R13-6000											
<b>1. Datos Generales</b>															
Nombre Estación	Fecha	Operador	T° Amb.												
SKC	18/02/18	Manuel Hidalgo	23°												
<b>2. Elementos de Calibración</b>															
<b>CILINDRO</b>															
Concentración	Vigencia	Tolerancia	Presión	Marca	Nº de Cilindro	Protocolo									
48, 17	22/01/20	+/- 10%	2300PSI	airgas	CC701127	E. P-1									
<b>CALIBRADOR</b>															
Fecha Última Calibración	Marca	Modelo	Nº de Serie												
30/01/18	Enviroson	6100	7959												
<b>GENERADOR AIRE ZERO</b>															
Fecha Última Mantenición	Marca	Modelo	Nº de Serie												
22/01/18	Teledyne	701	4310												
<b>3. Datos Monitor</b>															
Marca	Modelo	Nº de Serie	Rango												
Teledyne	T200	2280	0-500PPH												
<b>4. Calibración</b>															
Hora Inicio	Conc. deseada	Valores del Dilutor			Valores en el Analizador										Hora Termina
		Flujo			Sin Calibrar				Hora Calib.	Calibrado					
		Aire Lpm	Gas ccpm	Ozono O3	NO	Error	NOX	Error		NO	Error	NOX	Error		
15:45	0	3000	-	-	10.2	10.2	4.7	8.77	16.43	0.10	0.7	0.3	0.37	16.13	
16:48	400	3000	24	-	42.0	5.7	42.5	6.25	16.25	40	0.7	400	0.7	16.41	
16:41	0	3000	-	-	0.2	0.27	0.2	0.27	-	-	-	-	-	16:50	
Observaciones:															
 Firma															

Algoritmos		Ficha de Calibración Analizador de NO <sub>x</sub> -NO <sub>2</sub> -NO		R13-6000										
<b>1. Datos Generales</b>														
Nombre Estación	Fecha	Operador		T° Amb.										
SKC	18/02/18	Mauricio Huidobro		18°										
<b>2. Elementos de Calibración</b>														
CILINDRO														
Concentración	Vigencia	Tolerancia	Presión	Marca	N° de Cilindro									
49,17	22/09/20	± 1,0%	2300 Psi	airgas	4701127									
Protocolo														
EPA														
CALIBRADOR														
Fecha Última Calibración	Marca	Modelo	N° de Serie											
30/01/18	Emmerson	6100	7458											
GENERADOR AIRE ZERO														
Fecha Última Mantenición	Marca	Modelo	N° de Serie											
22/01/18	Teledyne	701	4310											
<b>3. Datos Monitor</b>														
Marca	Modelo	N° de Serie	Rango											
Teledyne	T200	2280	0-500 PPH											
<b>4. Calibración</b>														
Hora Inicio	Conc. deseada	Valores del Dilutor			Valores en el Analizador								Hora Termina	
		Flujo			Sin Calibrar				Hora Calib.	Calibrado				
		Aire Lpm	Gas ccpm	Ozono O3	NO	Error	NOX	Error		NO	Error	NOX		Error
21:01	0	3000	-	-	98	0.5%	1.5	1.5%	-	-	-	-	-	21:16
21:16	400	3000	24	-	387	0.5%	338	0.5%	-	-	-	-	-	21:22
21:22	0	3000	-	-	10	1.0%	0.6	0.6%	-	-	-	-	-	21:30
Observaciones:														

## **ANEXO IV FICHAS DE CALIBRACIÓN, SEGUNDO PUNTO CONDOMINIO**



Algoritmos		Ficha de Calibración Analizador de NO <sub>x</sub> -NO <sub>2</sub> -NO				Ri3-6000								
<b>1. Datos Generales</b>														
Nombre Estación	Fecha	Operador				T° Amb.								
Condominio Enxell	18/02/18	Maximiliano Hidalgo				20°								
<b>2. Elementos de Calibración</b>														
CILINDRO														
Concentración	Vigencia	Tolerancia	Presión	Marca	N° de Cilindro	Protocolo								
49,17	22/01/20	1/1,0%	2300PSI	airgas	CC701123	EPA								
CALIBRADOR														
Fecha Última Calibración		Marca	Modelo	N° de Serie										
30/01/18		Emerson	6100	7454										
GENERADOR AIRE ZERO														
Fecha Última Mantención		Marca	Modelo	N° de Serie										
22/01/18		teledyne	701	4310										
<b>3. Datos Monitor</b>														
Marca		Modelo	N° de Serie	Rango										
teledyne		T200	2280	0 - 500PPb										
<b>4. Calibración</b>														
Hora Inicio	Conc. deseada	Valores del Dilutor			Valores en el Analizador								Hora Termina	
		Flujo			Sin Calibrar				Hora Calib.	Calibrado				
		Aire Lpm	Gas ccpm	Ozono O3	NO	Error	NOX	Error		NO	Error	NOX		Error
22:00	0	3000	-	-	1.0	1.0%	0.6	0.8%	-	-	-	-	-	22:23
22:23	400	3000	24	-	403	0.15	407	1.15%	-	-	-	-	-	22:34
22:34	0	3000	-	-	0.4	0.4%	0.1	0.1%	-	-	-	-	-	22:41
Observaciones:														



Febrero, 2018

## **ANEXO V FICHAS DE CALIBRACIÓN, TERCER PUNTO CASINO**

<b>Algoritmos</b>	<b>Ficha de Calibración Analizador de NO<sub>x</sub>-NO<sub>2</sub>-NO</b>	<b>Ri3-6000</b>
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**1. Datos Generales**

Nombre Estación	Fecha	Operador	T° Amb.
Carmona en el	19/02/18	Moisés Hidalgo	19°

**2. Elementos de Calibración**

CILINDRO						
Concentración	Vigencia	Tolerancia	Presión	Marca	Nº de Cilindro	Protocolo
49, 17	22/09/20	+/- 1,0%	2300PSi	Oxygen	CC701127	E.P.A
CALIBRADOR						
Fecha Ultima Calibración		Marca	Modelo	Nº de Serie		
30/02/18		Emerson	6100	7454		
GENERADOR AIRE ZERO						
Fecha Última Mantención		Marca	Modelo	Nº de Serie		
22/01/18		teledyne	701	4316		

**3. Datos Monitor**

Marca	Modelo	N° de Serie	Rango
teledyne	T200	2280	0-500-PPb

**4. Calibración**

Hora Inicio	Conc. deseada	Valores del Dilutor			Valores en el Analizador										Hora Termino
		Flujo			Sin Calibrar				Hora Calib.	Calibrado					
		Aire Lpm	Gas ccpm	Ozono O3	NO	Error	NOX	Error		NO	Error	NOX	Error		
03:38	0	3000	-	-	0,0	0%	91	91%	-	-	-	-	-	-	03:47
03:47	400	3000	24	-	396	1%	399	0,25%	-	-	-	-	-	-	03:55
03:55	0	3000	-	-	0,2	0,2%	0,4	0,4%	-	-	-	-	-	-	04:06
Observaciones:															

Firma



<b>Algoritmos</b>	<b>Ficha de Calibración Analizador de NO<sub>x</sub>-NO<sub>2</sub>-NO</b>	<b>Ri3-6000</b>
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**1. Datos Generales**

Nombre Estación	Fecha	Operador	T° Amb.
Casino Enxex	19/02/18	Marcos Heddy	18°

**2. Elementos de Calibración**

CILINDRO						
Concentración	Vigencia	Tolerancia	Presión	Marca	Nº de Cilindro	Protocolo
49,17	22/08/20	±1.10%	2300PSi	Oxgas	CC101127	E-P.A
CALIBRADOR						
Fecha Ultima Calibración		Marca	Modelo	Nº de Serie		
30/01/18		Emerson	6100	7454		
GENERADOR AIRE ZERO						
Fecha Ultima Mantención		Marca	Modelo	Nº de Serie		
22/01/08		teledyne	701	4316		

**3. Datos Monitor**

Marca	Modelo	N° de Serie	Rango
teledyne	T200	2280	0-500 PPH

**4. Calibración**

Hora Inicio	Conc. deseada	Valores del Dilutor			Valores en el Analizador										Hora Termino
		Flujo			Sin Calibrar				Hora Calib.	Calibrado					
		Aire Lpm	Gas ccppm	Ozono O3	NO	Error	NOX	Error		NO	Error	NOX	Error		
08:16	0	3000	-	-	0,0	0%	0,1	0,1%	-	-	-	-	-	-	08:23
08:23	400	3000	21	-	399	0,25%	399	0,25%	-	-	-	-	-	-	08:32
08:32	0	3000	-	-	0,1	0,1%	0,5	0,5%	-	-	-	-	-	-	08:39
Observaciones:															

  
Firma

## **ANEXO VI FICHAS DE CALIBRACIÓN, CUARTO PUNTO CENTRO DEPORTIVO**

Febrero, 2018

Febrero, 2018



## **ANEXO VII**

### **CERTIFICADOS DE CILINDRO DE CALIBRACIÓN**





MVP 477

Airgas Specialty Gases  
Airgas USA, LLC  
600 Union Landing Road  
Cinnaminson, NJ 08077-0000  
Airgas.com

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E03NI99E15A0338 Reference Number: 82-400980288-1  
Cylinder Number: CC701127 Cylinder Volume: 144.4 CF  
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2015 PSIG  
PGVP Number: B52017 Valve Outlet: 660  
Gas Code: CO,NO,NOX,BALN Certification Date: Sep 22, 2017

Expiration Date: Sep 22, 2020

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.  
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	50.00 PPM	49.17 PPM	G1	+/- 1.0% NIST Traceable	09/15/2017, 09/22/2017
NITRIC OXIDE	50.00 PPM	49.16 PPM	G1	+/- 0.9% NIST Traceable	09/15/2017, 09/22/2017
CARBON MONOXIDE	3000 PPM	2980 PPM	G1	+/- 0.8% NIST Traceable	09/15/2017
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	16060604	CC437468	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jun 27, 2020
PRM	12367	APEX1099237	9.82 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Jun 02, 2017
GMIS	0315201604	CC503358	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Mar 15, 2019
NTRM	12060724	CC356171	2498 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Dec 21, 2017

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Siemens Ultramat 6 J3-595 COHIGH	NDIR	Sep 15, 2017
Nicolet 6700 AHR0801933 NO	FTIR	Sep 07, 2017
Nicolet 6700 AHR0801933 NO2	FTIR	Aug 29, 2017

Triad Data Available Upon Request



*C. Mody, Cerezo*  
Approved for Release

Page 1 of 82-400980288-1

## **ANEXO VIII RESPONSABLES Y PARTICIPANTES DE LAS ACTIVIDADES DE MUESTREO**

<b>Unidad de Operaciones</b>	Jefe de Operaciones
	Jefe Zonal
	Operadores
<b>Unidad de Mantención</b>	Jefe de Mantención
	Técnicos en Mantención
<b>Unidad de Monitoreo Atmosférico</b>	Jefe Unidad Monitoreo Atmosférico
	Encargado de Proyectos
	Ingeniero de Proyectos

## ANEXO C

MANDATO ESPECIAL DE EDMUNDO JIMENEZ A ALEJANDRO CASTILLO

CJ.



MANDATO ESPECIAL

ENAEX SERVICIOS S.A.

A

ALEJANDRO CASTILLO HAMATI

\*\*\*\*\*



EN SANTIAGO DE CHILE, a veintinueve de mayo del año dos mil diecisiete, ante mí, **EDUARDO AVELLO CONCHA**, Abogado, Notario Público Titular de la Vigésima Séptima Notaría de Santiago, con oficio en calle Orrego Luco cero ciento cincuenta y tres, Providencia, Santiago, comparece: Don **EDMUNDO JIMÉNEZ GALLARDO**, chileno, Ingeniero Civil Industrial, casado, Cédula Nacional de identidad número [REDACTED]


[REDACTED] en representación de **ENAEX SERVICIOS S.A.**, sociedad de Fabricación y Comercialización de Explosivos Industriales, Rol Único Tributario número setenta y seis millones cuarenta y un mil ochocientos setenta y uno guión cuatro, ambos domiciliados en calle El Trovador cuatro mil doscientos cincuenta y tres, comuna de Las Condes, Santiago; el compareciente mayor de edad, quien acredita su identidad con la cédula personal antes citada y expone: **PRIMERO:** Que en nombre y representación de la sociedad **ENAEX SERVICIOS S.A.** (en adelante también la "Sociedad"), viene en conferir



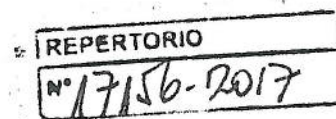
mandato especial al señor **ALEJANDRO CASTILLO HAMATI**, Cédula Nacional de Identidad número [REDACTED]; para que represente a la sociedad mandante y proceda a la tramitación íntegra de la auto denuncia generada por ENAEX SERVICIOS S.A. ante la División de Sanción y Cumplimiento de la Superintendencia de Medio Ambiente, hasta su conclusión y durante la tramitación íntegra del programa de cumplimiento por parte de la empresa auto denunciada. **SEGUNDO:** En el ejercicio de este mandato, el mandatario queda facultado expresamente para realizar y ejecutar todos los actos, trámites y actuaciones ante la Superintendencia del Medio Ambiente, el Servicio de Evaluación ambiental y en general ante cualquier organismo público o privado en relación con la auto denuncia ya referida, pudiendo al efecto efectuar toda clase de presentaciones y declaraciones, modificarlas o desistirse de ellas; suscribir a nombre de la Sociedad toda clase de formularios y/o solicitudes; comparecer ante todo tipo Instituciones o Entidades y sus respectivos funcionarios, por escrito o personalmente, solicitar audiencias y reuniones donde actuará en su representación, presentar recursos y ejercer todas aquellas facultades necesarias a que se refiere el Decreto número treinta y número treinta y uno que establece el Reglamento para Cumplimiento, Autodenuncia, Reparación y Operación del Sistema Nacional de Información de Fiscalización Ambiental, (SNIFA), la ley número veinte mil cuatrocientos diecisiete , artículo veintidos de la Ley número diecinueve mil ochocientos ochenta , Ley número veinte mil seiscientos y en general cualquier normativa referida al tema ambiental. **TERCERO:** El presente mandato se confiere para todo trámite o gestión en que se presente hasta la completa ejecución del encargo, pudiendo el mandatario nombrar abogados patrocinantes y apoderados con todas las facultades que en este instrumento se le confiere, y pudiendo delegar este poder y reasumir cuantas veces sea necesario. **CUARTO:** El presente mandato es de vigencia indefinida. **PERSONERIA** La personería de don **Edmundo Jiménez Gallardo** para representar a **ENAEX SERVICIOS S.A.** consta el acta de fecha diecisiete de diciembre de dos mil quince la que se redujo a escritura pública con fecha once de enero de dos mil dieciseis ante Raul Undurraga

EDUARDO AVELLO CONCHA  
NOTARIO PUBLICO  
Orrego Luco 0153  
Fono 22600400 - 226200418  
Providencia



Laso Notario Público de Santiago y no se inserta a expresa solicitud del compareciente.- En comprobante y previa lectura, el compareciente firma. Se da **DOY FE.** = 

  
EDMUNDO JIMÉNEZ GALLARDO  
P.P. ENAEX SERVICIOS S.A.



ESTA COPIA ES TESTIMONIO FIEL DE ORIGINAL  
Santiago, 29 MAYO 2017



CUMPLIENDO EL ART 404 COD. ORG TRIB.  
DE PAGINA O CARTELA  
**UTILIZADA**

