

M E T A LTD.

THE INNOVATORS IN GAUGING

META

SMK-9000

**EXHAUST GAS MONITORING SYTEM FOR IN-LINE ENGINES
(12 CYLINDERS)**

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EXHAUST GAS MONITORING SYTEM FOR IN-LINE ENGINES

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1. CERTIFICATION OF COMPLIANCE

CUSTOMER : *MARELEC*

MARINE ELECTRICAL SERVICES

CUSTOMER P/N : *6961067 (1 ./ 4)*

SYSTEM TYPE : *SMK-9000*

DESCRIPTION : *EXHAUSTGAS MONITORING AND ALARM SYSTEM*

FOR IN-LINE ENGINES

QUANTITY: *4 X Units*

Seller certifies that the articles described herein shall be free from defects in workmanship. They have been inspected and are in full accordance with the applicable requirements, specifications and drawings of said purchase order.

We certify that inspection evidence, including test data necessary to substantiate this certifications is available in our files.

FOR META

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DATE*27 Juli 2016*

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2. EMI-CONFORMITY

GENERAL

META measuring equipment complies with the EMI-guidelines.

Throughout production and associated tests special attention is focussed on EMI and the most contemporary guidelines applied to protect and prevent the apparatus against EM-radiation.

The equipment connected to the heads also influences the EMI-behaviour of the heads and special consideration has to be taken pertaining :

DIGITAL DATA-LINES :

Connection of measuring equipment with external devices such as printers , digital processors etc. must always be established via shielded cables.

It is recommended to attach the shield on one side with earth.

SIGNAL-LINES :

Signal conductors between head and measuring equipment should be held as short as necessary.

In normal case the line length should not exceed the 10 meters.

For all signal lines shielded connections are prescribed.

It is not allowed to install signal lines along with mains and especially with ac-carriers.

NEGATIVE INFLUENCES ON THE GAUGE :

In applications where strong electromagnetic fields surround the measuring gauge deviations of the specified measuring results could be expected.

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3. SAFETY

WARNINGS

- Avoid banging and knocking the electronics/sensors
 - ⇒ Damage to or destruction of the electronics/sensors
- Power supply must be connected in accordance with the safety regulations for electrical equipment
 - ⇒ Danger of injury
 - ⇒ Damage to or destruction of the sensor safety
- Protect the cables against damage
 - ⇒ Failure of the measuring device

PROPER USE

- The SMK-9000 systems gauges are designed for use in industrial/marine areas.
- They are used for machine supervision and for measuring and testing in process quality assurance.
- The systems may only be used in such way that does not endanger persons or cause damage to the machine due to malfunctions or total failure of the system.
- Additional precautions for safety and damage prevention must be taken for safety-related applications

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4. APPLICATIONS

META's standard Exhaust Gas Monitoring System for in-line Engines with two Banks Bank Right (/A) and Bank Left (/B) with 12 Cylinders.

META's standard Exhaust Gas Monitoring System for in-line Engines with with two Banks Bank Right (/A) and Bank Left (/B) with 16 Cylinders.

System Extension can include Monitoring of 2X Turbo Chargers Temperatures.

The System is designed on Microprocessor Basis and Touch-Screen Display 7 “.

Specifications*	SMK-9000
Measuring range	depending on measuring sensors (Thermocouples Type K , N, J, E)
Measuring principal	continuous
Supply Voltage	24 VDC (+15% ./ -20%)
Protection Class	IP 54
Ambient Conditions	up to 60°(no cooling), 10-95 % rH
Weight	ca 15 kg
dimensions (WxHxD) [mm]	400 X 500 X 200

* For other customised data contact factory

* META reserves the right to change these specifications without notice

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5. SYSTEM DESCRIPTION

By turning the external Power-Switch on firstly the System performs an internal Built In selfTest (BIT). During that Test the System Processor as all peripheral Inputs and Outputs Components are tested.

During that Time all LEDs on the main CPU-Board are turn on.

After a few Seconds only the LEDs “DC5V” and “RUN” are lit (green).

If the System fails to pass the Test the upper LED “SF” turns and keeps red.

(In that Case please contact System Responsible or META)

The Display of the System is provided with a protecting “Screen Saver”.

Thus after 10 Minutes, when no Activity has been registered the System Screen turns dark which means the Screen Saver has been energized.

A light Finger-Tip on the Screen Window reenergises the Screen Display again.

The Display Unit is provided with a 3 V Lithium Battery of Type CR2032 (Slot I)

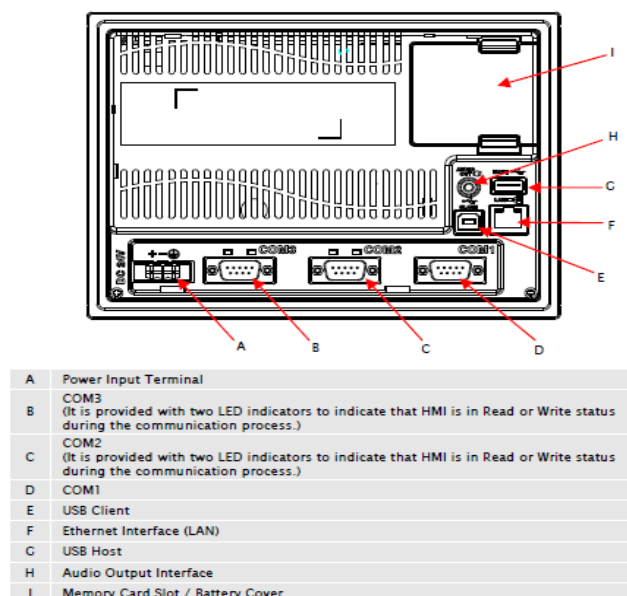


Fig.5.1 : Rear Site of Display Unit

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MONITORING FUNCTIONS

Temperature Values :

The exhaust Gas Temperature of each Cylinder is individually and continuously monitored and displayed on the Screen along with its maximum allowed Alarm value.

Two Screens are provided (Bank R and Bank L) for the Monitoring of all Values.

Additionally the Average Value of each Engine Bank is monitored.

In Case a particular Temperature exceeds the maximum allowed Value an optical and audible Alarm is generated.

The User is given the Capability to acknowledge (“ACKN”) the particular Alarm, an Action which supresses the audible Alarm but the optical Alarm is still activ till the cause generated it has been eliminated.

Once acknowledged the “ACKN” Button turn its colour from green to yelow.

Additionally in Case of Alarm Occurence the associated Alarm Message appears in “moving”- mode at the Bottom of each Page.

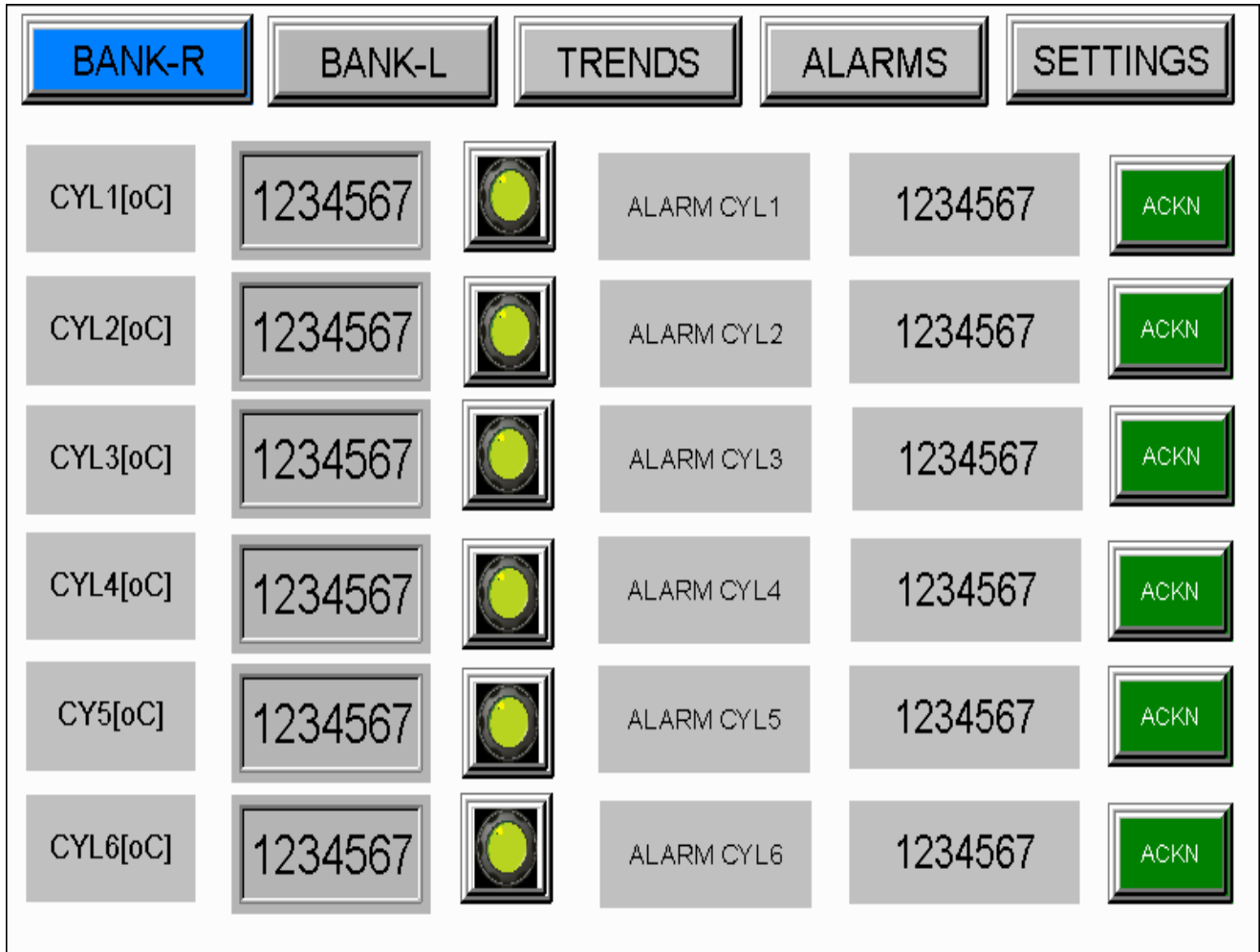


Fig 5.2 : Display Page , Temperature Display, Bank R (A)

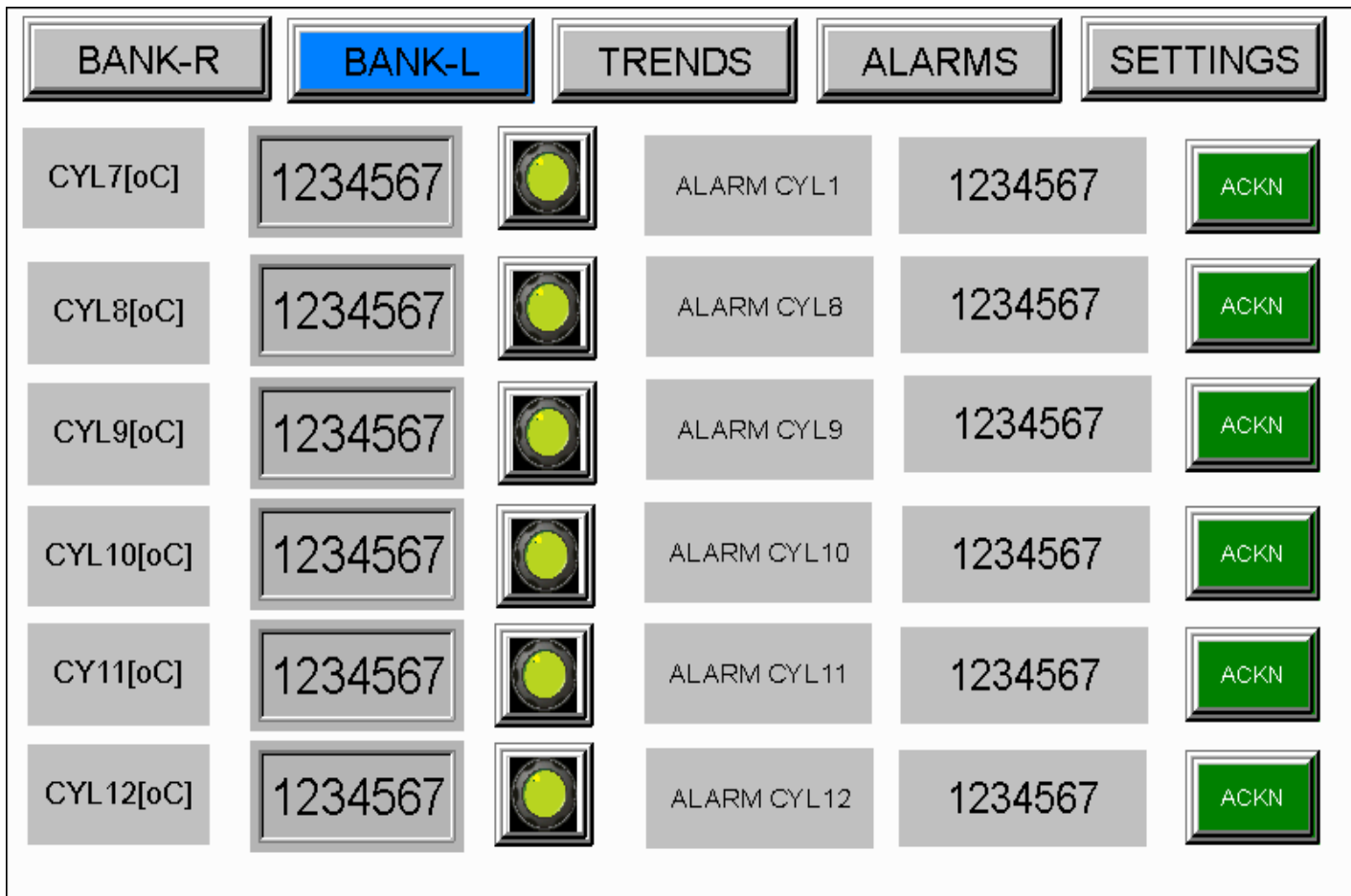


Fig 5.3 : Display Page , Temperature Display, Bank L (B)

Following additional Functions are provided :

Trends :

The System provides a graphical Display showing the values of the Average Bank-Temperatures over the time along with their Margins (High/Low Boundary).

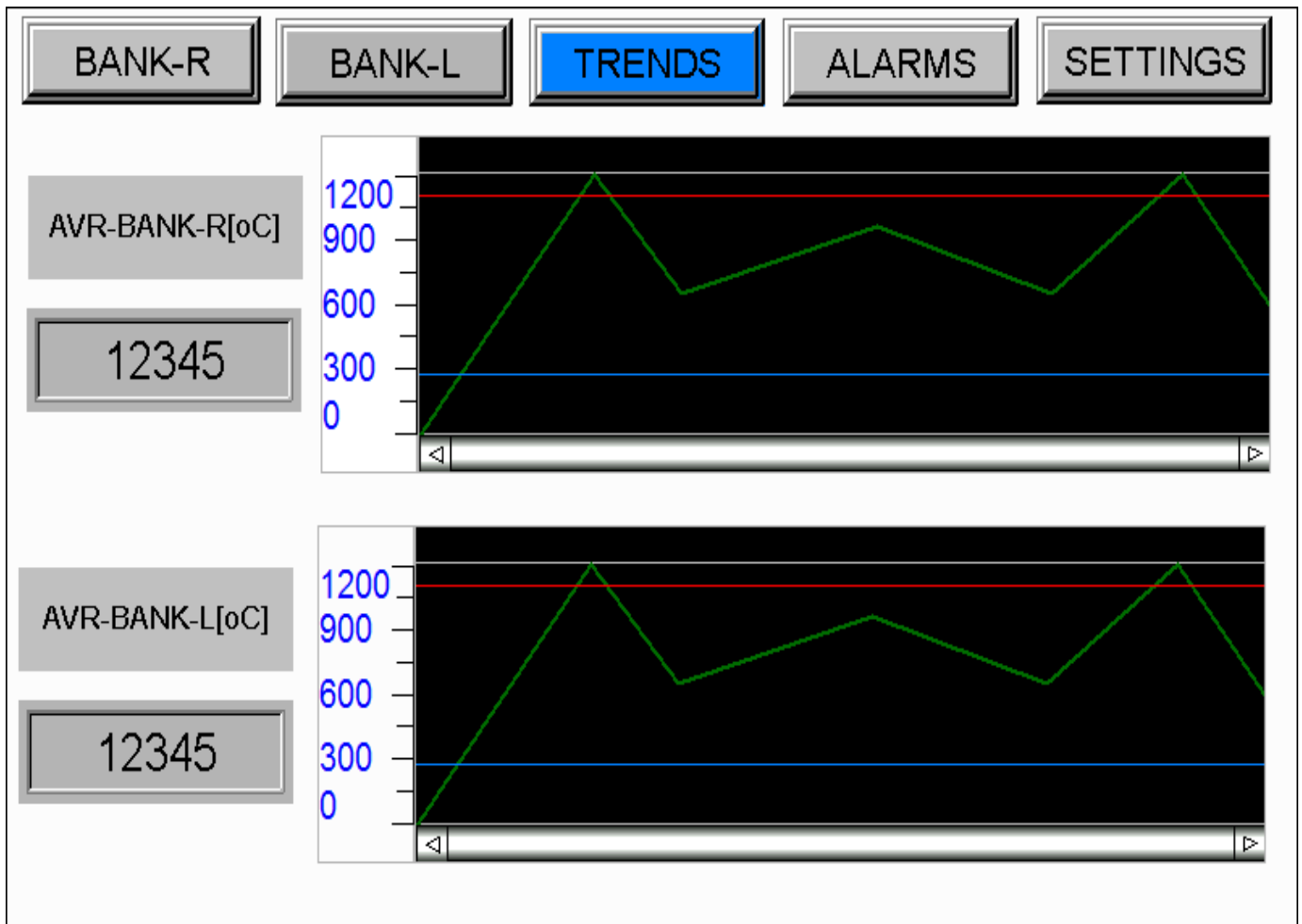


Fig 5.4 : Display Page , AverageTemperatures Display for Bank R and L



Alarms :

The Screen Alarms displays in Form of a Alarm History Table each comming or already going Alarm with its Designation and the Time Stamp when Alarm occurred or has been gone.

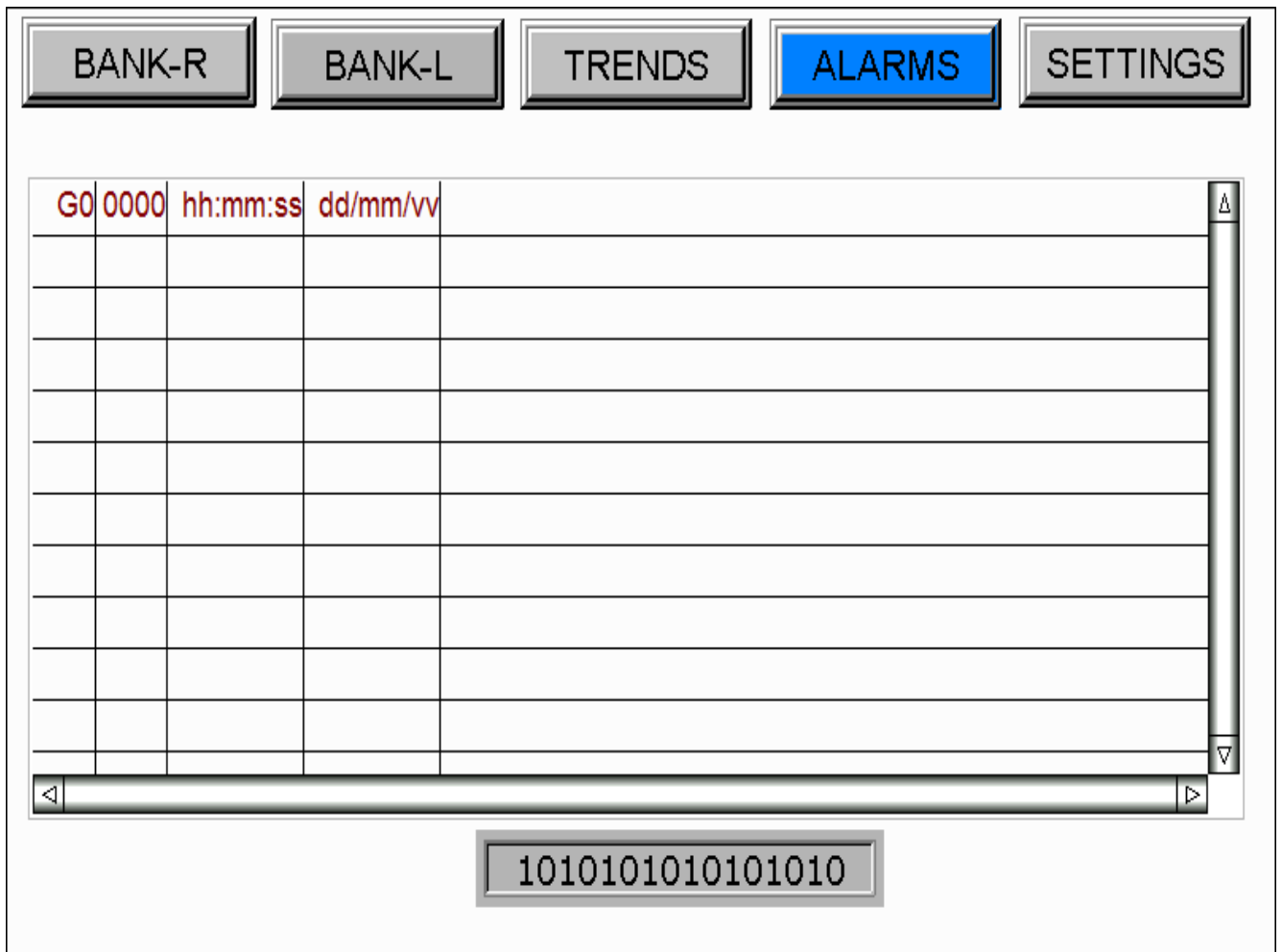


Fig 5.5 : Display Page , Alarm Table



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Settings :

Through the System Screen “Settings” the responsible Engineer has been given the Capability to change the Alarm upper (maximum) allowed Limits

This Screen is Password protected to only allow willingful Actions.

The Password ist System Function and set as Input

Password = 1 2 3 4 without blanks

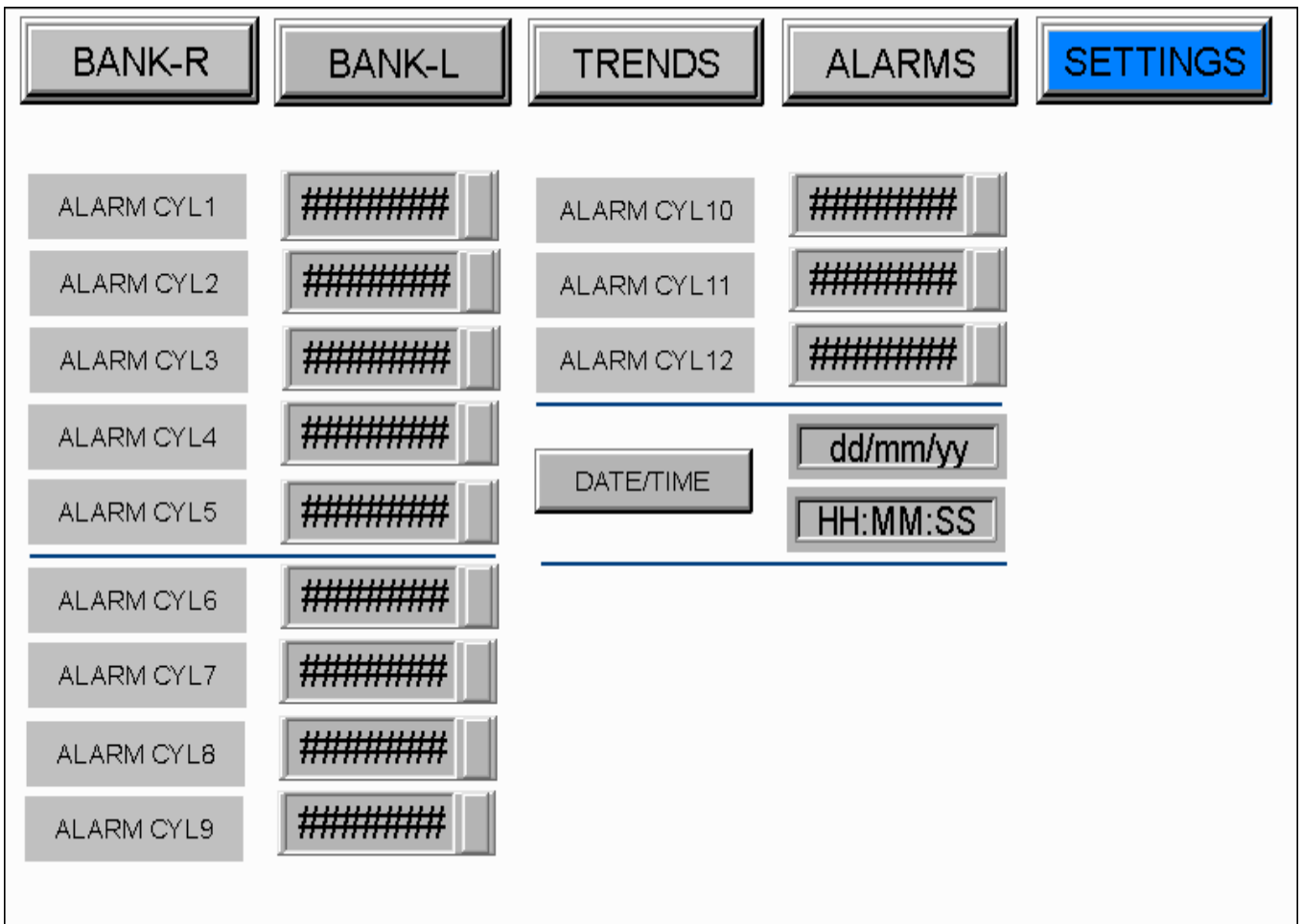


Fig 5.6 : Display Page , Settings

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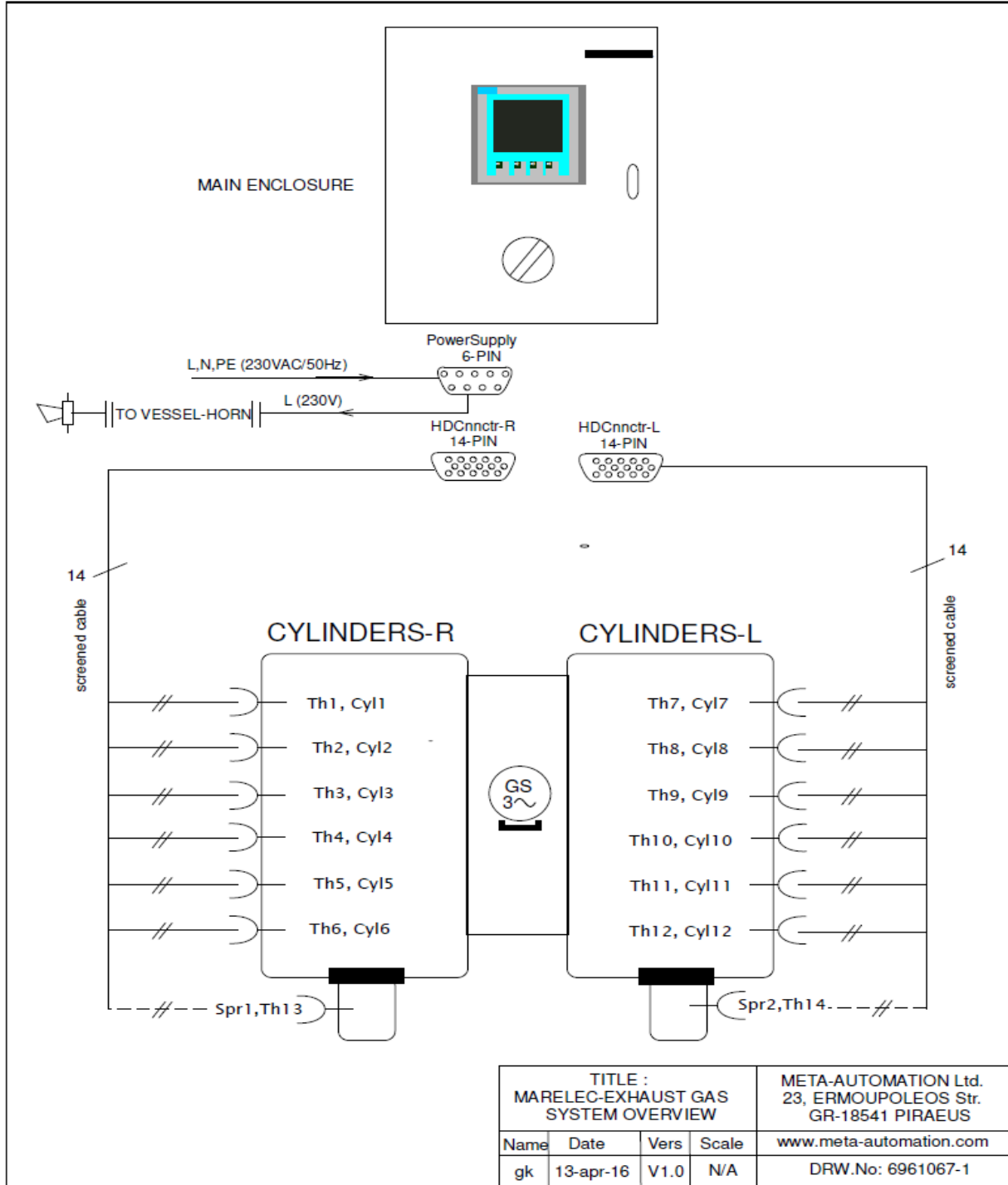
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6. MECHANICAL SYSTEM OVERVIEW

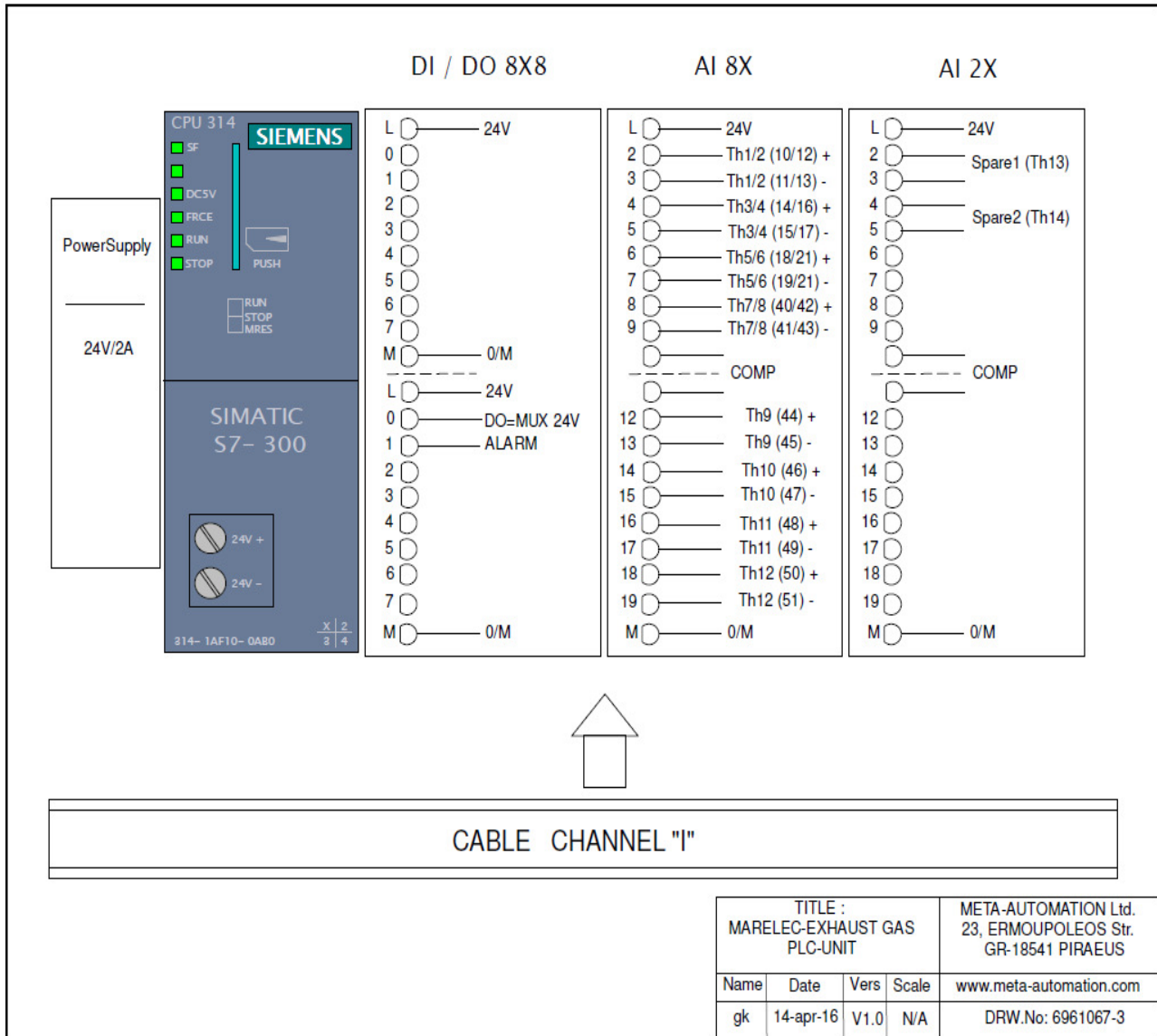




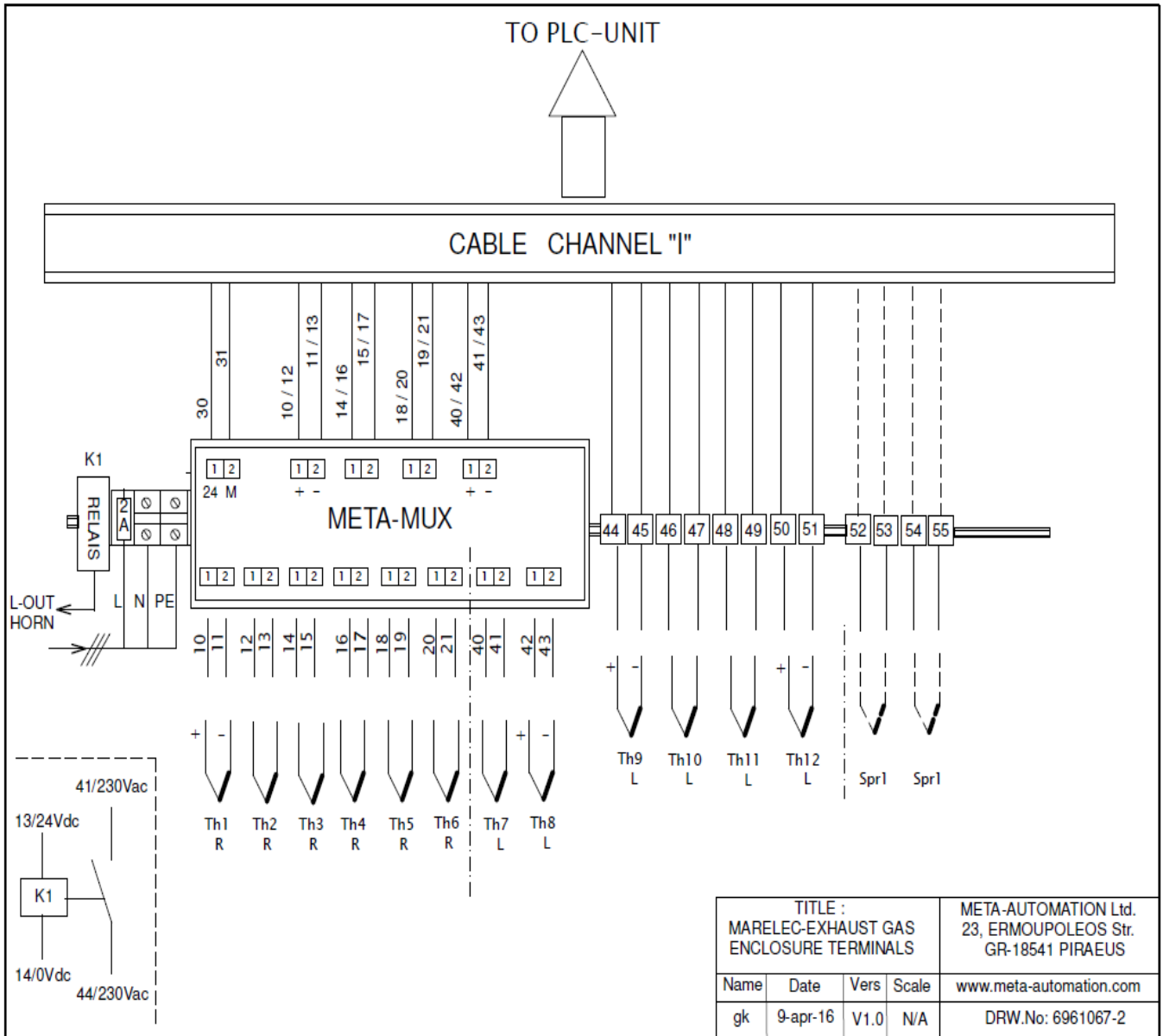
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7. WIRING

PROCESSOR UNIT WITH PERIPHERALS



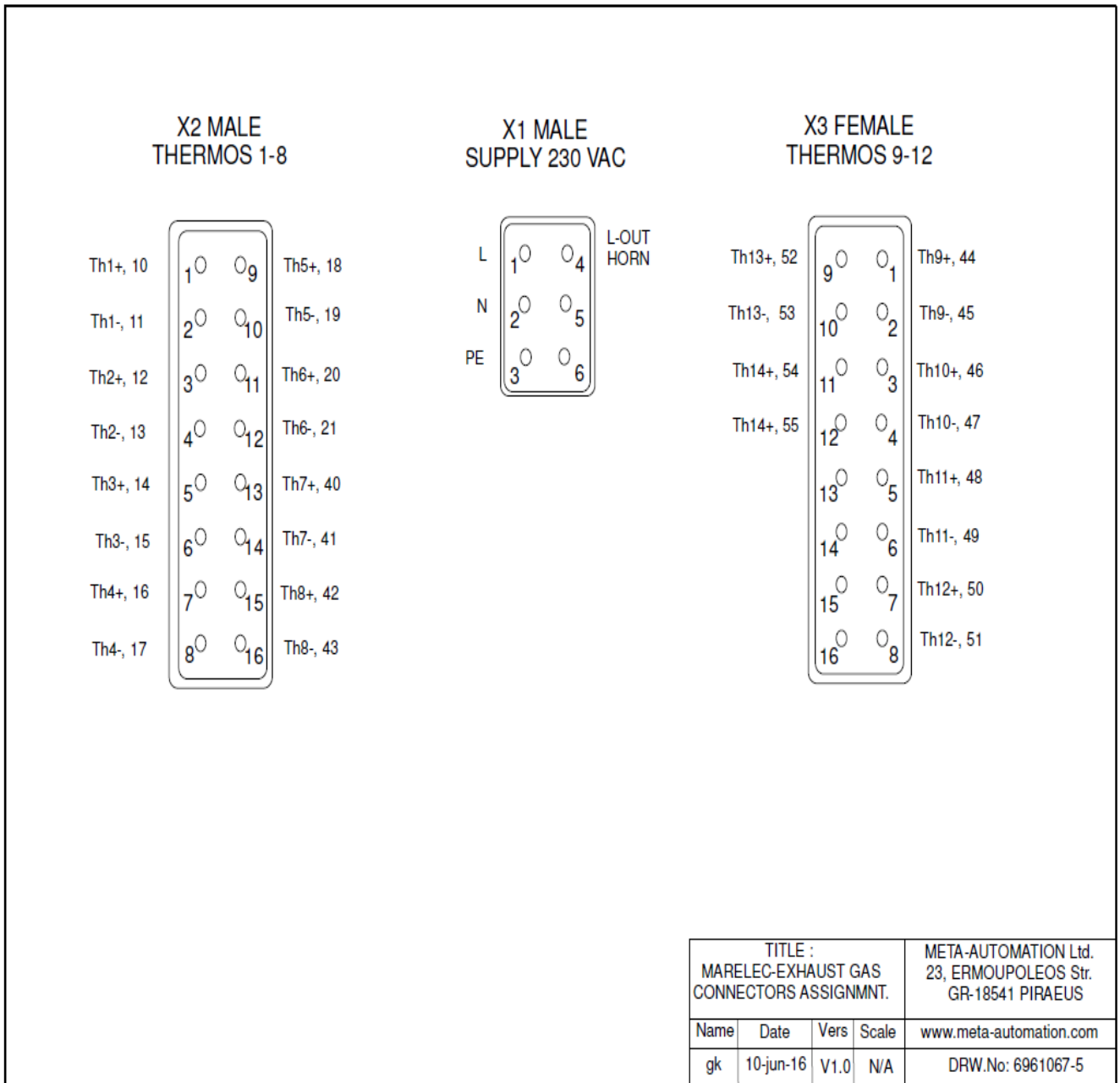
INTERNAL WIRING AND TERMINALS





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EXTERNAL WIRING CONNECTORS (TO SENSORS)



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8. POWER SUPPLY REQUIREMENTS

User-side the power supply must be secured by fuse (2A) according to following requirements

Supplying voltage :

Nominal Input Voltage 100 - 240 Vac / 50 - 60 Hz ,

Voltage Range 85 - 264 Vac

Frequency Range 47 - 63 Hz

Turn-On Time <2 Sec @100 Vac, 0.8 Sec @230 Vac

Recommended Fuse 2A installed at the "L" – Terminal of the System
(black plastic Screw)

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9. SPARE PARTS RECOMMENDED

Item	Designation	Quantity
1	MicroProcessor Full Row of I/O, Type Siemens S7 (MMC preconfigured), META-Version 01	1X
2	Thermo-MUX, META-Type8X4	1X
3	Power Supply Module, Type DELTA 230 Vac/24 Vdc,	1X
4	DELTA Display, 24 Vdc Type DOP-B (preconfigured)	1X
5	Fuse FA 2A (Box Terminal L) *	1XPackage
6	Battery Type CR2032 *	1XPackage

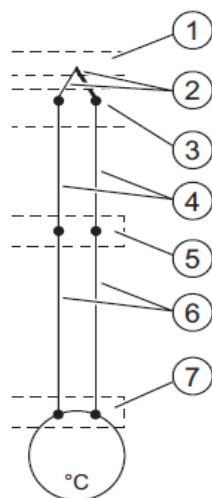
* Source : Common Public Trade, No Specificas

10. APPENDIX 1 : MEASUREMENT THERMOELEMENTS TYPE K

THERMOCOUPLE STRUCTURE :

Thermocouples (Thermoelements) consist of a pair of thermal Probes and all necessary Installation and connecting Parts. The Thermocouple Pair consists of two Wires made of different Metals, or of metal Alloys soldered or welded together at their Ends.

The different Thermocouple Types, for example, K, J or N, are derived from different Material Compositions. The measuring Principle of all Thermocouples is the same, irrespective of their Type.



- ① Measurement point
- ② Thermocouple with positive and negative thermal elements
- ③ Terminal
- ④ Compensating line
- ⑤ Reference junction
- ⑥ Supply line
- ⑦ Thermal voltage acquisition point

Fig 10.1 Thermocouple Structure

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OPERATING PRINCIPLE OF THERMOCOUPLES :

Any Temperature Difference between the measuring Point and the free Ends of the Thermocouple (Point of Connection) generates a thermoelectric Voltage. The thermoelectric Voltage is a Function of the Temperature Difference between the measuring Point and the free Ends, and is also determined by the Material Composition of the thermal Elements.

As Thermocouples always sense Temperature Differences, it is essential to maintain the free Ends at the known Temperature of a Reference Junction in order to be able to determine the Temperature at the measuring Point.

The Thermocouples can be extended from their Point of Connection to the Reference Junction by means of compensating Lines. These compensating Lines are made of the same Materials as the Thermocouple Wires. The Supply Lines from the Reference Junction to the module are made of Copper.

Note : Make sure of the correct polarity in order to avoid serious measuring errors.

COMPENSATION FOR THE REFERENCE JUNCTION TEMPERATURE:

You can compensate for the Influence of Temperature Fluctuation at the Reference Junction by means of a compensating Circuit.

You have several Options of measuring the Reference Junction Temperature in order to obtain an absolute Temperature Value as a Function of the Temperature Difference between the Reference Junction and the measuring Point.

You can use either an internal or an external compensating Circuit, depending on the required Location of the Reference Junction.

COMPENSATION OPTIONS :

1) No Compensation : To record only the Temperature Difference between the measuring Point and Reference Junction.

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II) Internal Compensation : that Compensation is based on a Comparison using the internal Temperature (Thermocouple internal Comparison) of the Module.

III.a) External Compensation : with Compensation Box in the Feed Lines of each Thermocouple.

Here one has already had measured and compensated for the Reference Junction Temperature (Thermocouple external Comparison) using an interconnected compensating Box in the Feed Lines of each Thermocouple.

III.b) External Compensation with Resistance Thermometer

for recording the Reference Junction Temperature. One can measure the Reference Temperature using a (Platinum or Nickel) Resistance Thermometer, and compute it in the Module for any Thermocouple.

WIRING AND CONNECTING THERMOCOUPLES WITH INTERNAL COMPENSATION :

FUNCTION PRINCIPLE OF INTERNAL COMPENSATION:

Internal Compensation allows you to form the Reference Point at the Terminals of the analog Input Module. In that Case, route the compensating Lines directly to the analog Module. The internal Temperature Sensor measures the Module's Temperature and returns a Compensation Voltage.

WIRING AND CONNECTING :

Wire the thermocouples either directly to the Inputs of the Module, or indirectly via compensating Lines. Each Channel Group can use any Type of Thermocouple supported by the analog Module, independently of other Channel Groups.

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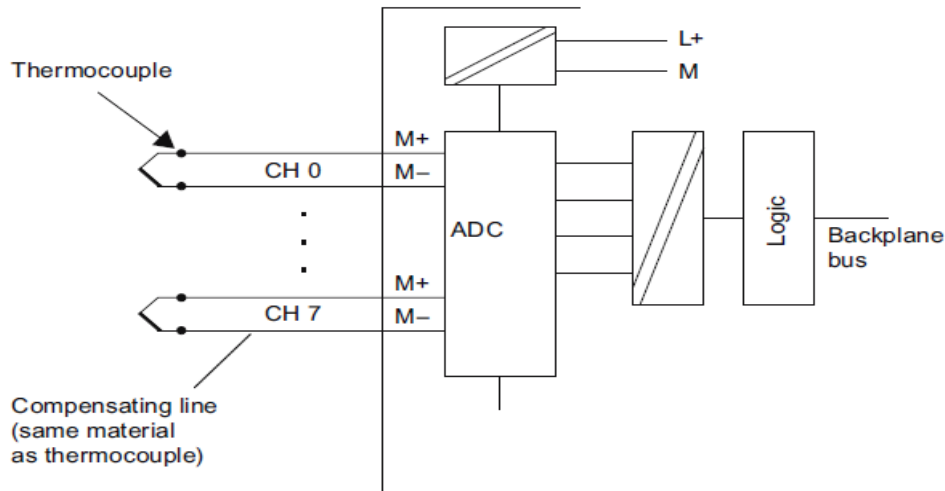


Fig.10.2 : Wiring and Connecting of Thermocouples using internal Compensation

WIRING AND CONNECTING THERMOCOUPLES WITH EXTERNAL COMPENSATION:

FUNCTION PRINCIPLE EXTERNAL COMPENSATION WITH COMPENSATING BOX:

With external Compensation, the Temperature at the Reference Junction of the Thermocouples is evaluated using a compensating Box.

The compensating Box contains a Bridge Circuit which is calibrated to a defined Reference Junction Temperature /Calibrating Temperature.) The Reference Junction is formed by the connecting Ends of the Thermocouple's equalizing Conductor.

The Resistance of the Temperature-sensitive Bridge Changes as a Function of the Difference between the actual Reference Temperature and calibrating Temperature. This Difference induces a positive or negative compensating Voltage, which is added to the thermo-electrical Voltage.

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WIRING AND CONNECTING THE COMPENSATING BOX :

terminate the compensating Box at the COMP Terminals of the Module; the compensating Box must be installed at the Reference Junction of the Thermocouples.

The compensating Box should be supplied with an electrically isolated Voltage. The Power Supply Module must provide adequate Noise filtering, for Example, by means of grounded Cable shielding. The Thermocouple Terminals on the Compensation Box are not required, and should be shortcircuited

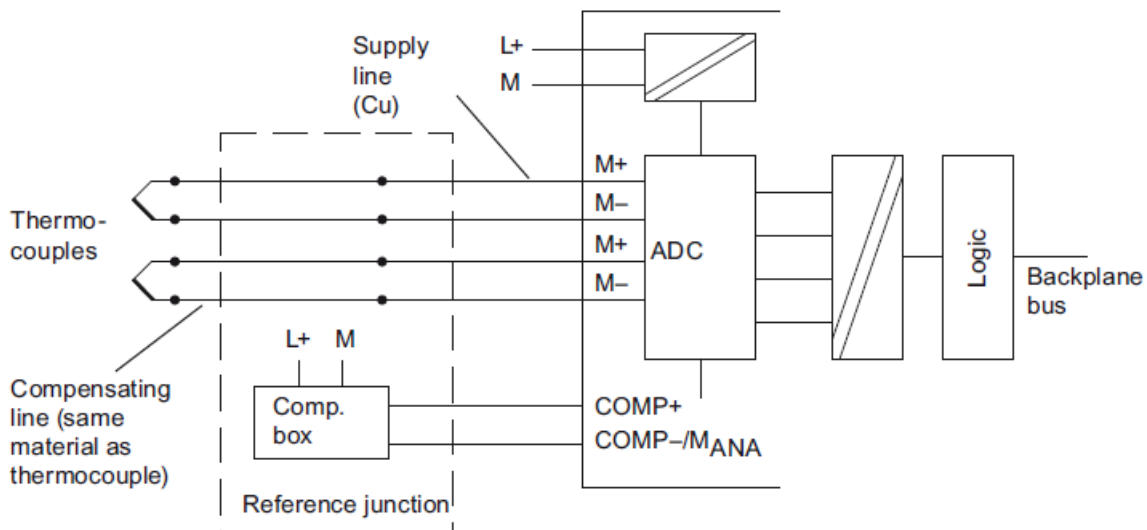


Fig.10.3 : Wiring and Connecting of Thermocouples using external Compensation

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11. APPENDIX 2 : DIAGNOSTIC MESSAGES OF SYSTEM

CPU Diagnostic LEDs

- SF ... (red) ... hardware or software faults
- DC5V ... (green) ... 5 V DC supply for CPU and S7-300 bus is ok
- FRCE ... (yellow) ... force request is active
- RUN ... (green) ... CPU in RUN; LED flashes at start-up with 1 Hz; in HALT mode with 0.5 Hz
- STOP ... (yellow) ... CPU in STOP or HALT or start-up

Modules Diagnostics

Diagnostics message	LED	Scope of diagnostics	programmable
External load voltage missing	SF	Module	no
Configuration / programming error	SF	Channel	yes
Common-mode error	SF	Channel	yes
Wirebreak	SF	Channel	yes
Underflow	SF	Channel	yes
Overflow	SF	Channel	yes