6.2 Polarization keys.

Insertion of Barrier Modules on the termination board is polarized by the presence of up to 4 plastic prongs protruding from the four bottom corners of the module's case, and corresponding mating holes on the termination boards module slot position.
The purpose of this polarization is to prevent plugging a barrier module having higher maximum voltage or current into a slot and consequently an I.S. circuit intended to accept lower max voltage or current.
Refer to section 7.6 and 7.7 for further information on I.S. circuits.
Module polarization is factory set by cutting the appropriate combination of prongs according to the corresponding safety parameters group.
Termination board polarization is factory set per customer specifications by plugging the appropriate holes with plastic snap on buttons on each modules slot according to the module to be allocated.

Where there is no customer specification of termination board polarization, the board is supplied by default with all holes plugged by plastic buttons.
Spare plastic buttons (P.N. 601077) can be supplied by Elcon on request. The customer can easily remove unrequired buttons by lifting their head with a sharp screwdriver blade and snapping them off to accommodate other types of modules (see figure 3 for polarization mode of type 1011-12 / 1061-62 / 1071-72).

6.3 Termination Board Mounting.

SINGLE MODULE UNIT.
Snaps onto 35 mm. symmetrical top hat bar installed on the mounting surface.

1108 and 1208 or 1116 and 1216 (CW or TB) TERMINATION BOARDS.
These types of termination boards have different width for 8 and 16 modules position and different depth for Cross-Wiring (CW) or non cross-wiring (TB) originating eight different board sizes.
On the passivated metal chassis of the board, four slots in the corner permit sliding the board sideways in the installation screws without needing to remove them, making installation easier.

N O T E: 1208 and 1216 Boards versions are optimized for vertical mounting arrangement.

a) Drill four holes according to drawing on pages 13-14 (select holes spacing appropriate to your type) noting the accuracy of hole spacing.
Consider that you can place the Termination Board both horizontally and vertically and drill the holes accordingly.

b) Tap holes M4 (or # 8-32) and insert four M4 x 10 (metrical size) or # 8-32 x 1/2" length flat head s crews; leave bottom surface of screws heads spaced 3 mm (1/8") from surface.

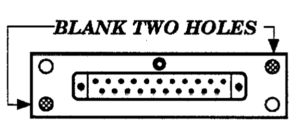
c) Laterally slide (or upward in vertical mounting) the board chassis on two screws up to the full slot stop.

d) Lay the board chassis against the mounting surface and slide it half way on the other two screws slots.

e) The chassis is now locked with the four mounting screws on their respective slots mid position, tighten the screws with a suitable screw driver from the top surface of the board through the corner openings.

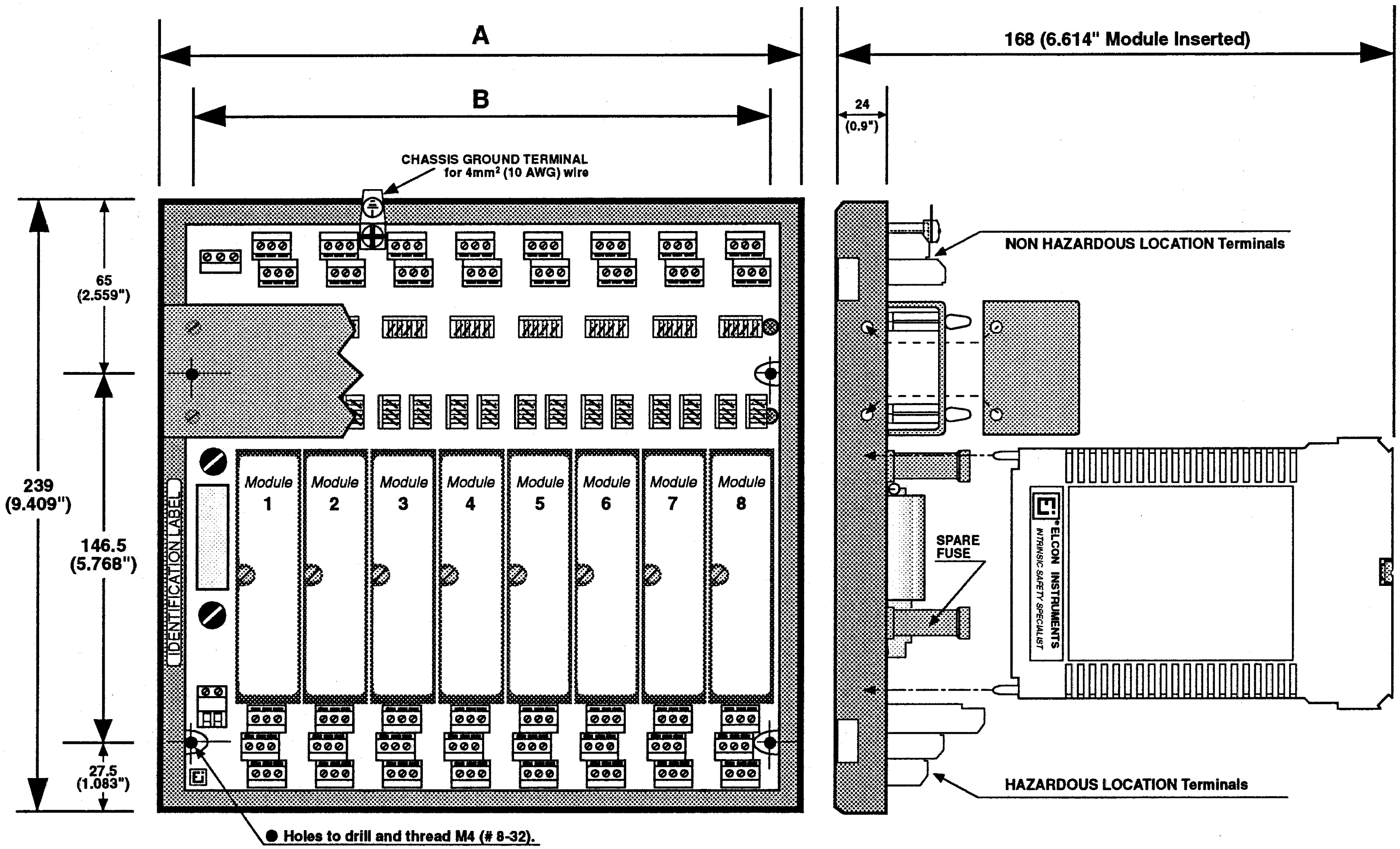
6.4 Modules Mounting.

Barrier module is a plug in unit that must be inserted in the appropriate termination board position or "slot".
Exercise care in the insertion to center the polarization holes and mate the connectors pins, then firmly press the module to engage the connector. Later fasten the fixing screw to firmly secure the module to the termination board.

CONFIGURATION	*- TERMINATION BOARD -* *(Components side view)*		*POLARIZATION PROCEDURE*
7		13.1 V / 26 mA	*ON THE TERMINATION BOARD.* Obstruct by plugs (ELCON PN. 601077) the polarization holes in accordance with this drawing.

- Fig. 3 -

OVERALL DIMENSIONS and DRILLING for TERMINATION BOARDS with cross wiring Mod. 1108/CW and 1208/CW - 1116/CW and 1216/CW



NOTES:

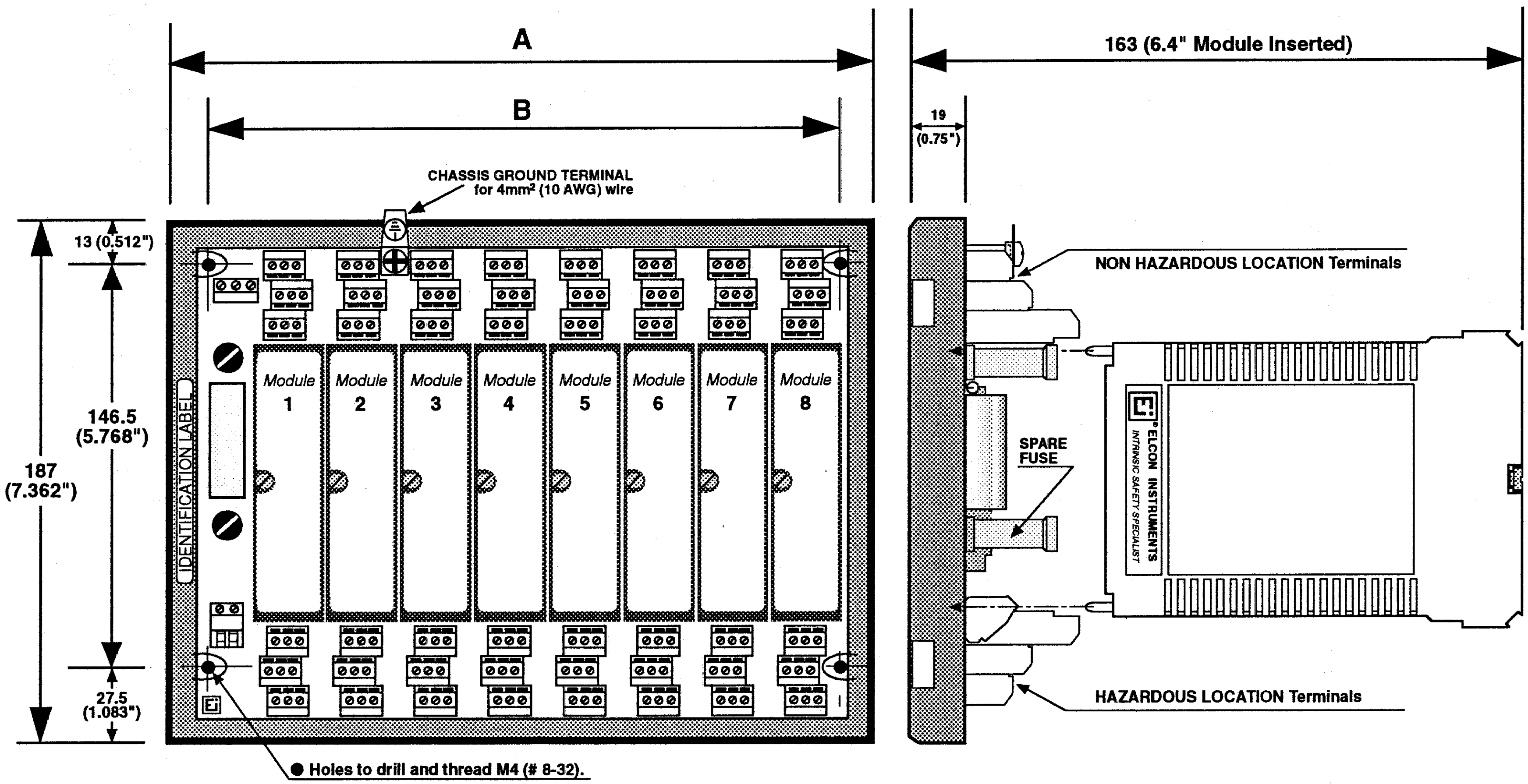
All dimensions are in mm (Dimensions in parenthesis are in inches).

Leave at least 41 mm (1.614") spacing between holes of one Termination Board to the holes of the near Terminat. Board.

DIMENSIONS for Board with Cross-Wiring (CW version)

	1108	*1208*	*1208 CON*	*1116*	*1216*	*1132/TB*	*1132/CON-SH5*
A	246 (9.685")	282 (11.102")	282 (11.102")	460 (18.110")	535 (21.063")	246 (9.685")	246 (9.685")
B	220 (8.661")	255.5 (10.059")	255.5 (10.059")	434 (17.087")	509 (20.039")	220 (8.661")	220 (8.661")

OVERALL DIMENSIONS and DRILLING for TERMINATION BOARDS without cross wiring Mod. 1108/TB and 1208/TB - 1116/TB and 1216/TB



NOTES:

All dimensions are in mm (Dimensions in parenthesis are in inches).

Leave at least 41 mm (1.614") spacing between holes of one Termination Board to the holes of the near Terminat. Board.

DIMENSIONS for Board without Cross-Wiring (TB version)

	1108	1208	1116	1216
A	246 (9.685")	282 (11.102")	460 (18.110")	535 (21.063")
B	220 (8.661")	255.5 (10.059")	434 (17.087")	509 (20.039")

6.5 High density installations (Applicable also to control panels).

EFFECTS OF OPERATING TEMPERATURE

The failure rate probability of any electronic component has an exponential relation to the increase of its operating temperature (Arrhenius theory).

For instance, a change from 25 to 50°C (77 to 122°F) can cause a failure rate ten times higher, with consequential downgrading of components and of calibration stability.

The operating temperature of electronic circuits should be as low as possible by placing installations in a cool or conditioned environment.

COOLING OF CONTROL CABINETS

The installation of electronic equipment in a control cabinet determines an adverse increase in its operating temperature proportional to the dissipated power.

It is important that optimum power dissipation in the cabinet as well as the elimination of the produced heat be provided, so as to minimize the increase above the ambient temperature.

An obvious measure consists of installing the equipment which is mostly affected by temperature in the bottom portion of the cabinet, where temperature can be 15 - 20°C (27 - 36°F) lower than in the upper part.

The most common panel cooling methods, in increasing order of effectiveness, are:

A) NATURAL CONVECTION
B) FORCED VENTILATION
C) AIR CONDITIONING

A) Natural convection in closed panels

It is the least effective and should be used only when the dissipated power is moderate and when the system operates in a dusty or aggressive (harsh) environment.

The temperature rise and dissipable power for a given temperature rise are expressed by the following formulas:

$$\Delta t = \frac{P}{S \times K} \quad \text{and} \quad P = \Delta t \times S \times K$$

Where Δt *(°C) = Temperature rise*
P (WATT) = Dissipated power
S (m^2) *= Heat exchanging surface*
K $\left(\frac{W}{m^2 \times °C}\right)$ *= Thermal conductivity coefficient*
K = 5.5 for painted steel sheets

As an example, suppose a typical 600 x 2000 x 600 mm cabinet installed with the four sides free (heat exchanging surface = 5,2 m^2) and considering a temperature rise $\Delta t = 10°C$ (18°F), the possible power dissipation in the cabinet is:

$P = 10 \times 5.2 \times 5.5 = 286$ *WATTS*

A1) Natural convection in open panels

In this case, in addition to the heat exchange with panel sides, most heat is removed by cool air flowing through the equipment.

Inlet and outlet ports in the lower and upper ends of the cabinet will provide air flow.

The air flow path must be kept free from obstacles and directed through the equipment maximizing the "chimney effect" of natural air convection.

For a cabinet like the one considered in the example of case A and properly engineered as discussed above, the resulting improvement is of about 100% (That is twice the dissipable power or half of the temperature rise for the same power).

B) Forced ventilation with heat exchanger in closed panels

It can be used in "harsh" environments like in case A but having a higher dissipated power such as not to permit the natural air convection approach.

A heat exchanger with a fan pulls the air into the cabinet and forces it into the heat exchange plate or membrane that, on the opposite side, are cooled by the external ambient air moved by a second fan.

By using such an exchanger, provided it is efficient and well maintained (frequently cleaned filters and heat exchanging surfaces), the allowable power dissipation for equal temperature rise can be 5 to 6 times higher than the simple natural convection in closed cabinets, that is for the assumed example 850 - 1000 WATT.

It is mandatory to properly maintain and clean air filters and heat exchangers, since dust accumulation can dramatically reduce both air circulation flow and the consequential thermal exchange.

B1) Forced ventilation in open panels

Here filtered air is taken from the bottom cabinet openings by one or more fans creating an air flow through the equipment and exhausting it out the top cabinet openings.

As in case A1 of natural convection, the air flow path must be free from obstacles and forced to pass through the equipment.

Fan dimensioning is based on the air pressure to be sufficient to overcome filter and cabinet inside pressure losses for the required air flow, that is expressed by the formula:

$$Q = \frac{3.1 \times P}{\Delta t}$$

where
Q is the required minimum air flow in m^3/h
P is the power in watts to be dissipated in the cabinet
Δt *is the temperature rise in °C of the cabinet*

For the cabinet assumed as an example (neglecting the cooling contribution of the cabinet side surfaces) for a $\Delta t = 10°C$ (18°F) and a power of 1000 WATTS the minimum required air flow is:

$$Q = \frac{3.1 \times 1000}{10} = 310\ m^3/h$$

C) Air conditioned cabinets

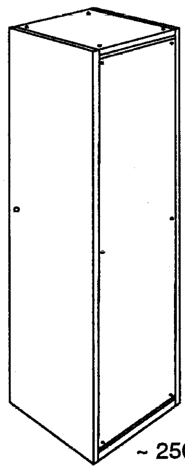
This approach offers the advantage of obtaining a cabinet temperature equal or even lower than the ambient temperature, becoming the ideal solution for hot climates.
A specific refrigerating system can be used or, when applicable, the existing air conditioning system can be used also for cabinet conditioning.
In every case the refrigerating power must be related to the heat to be removed due to the dissipated power which determines the refrigerator size.

Abstract of possible different solutions and relevant examples

Heat dissipation in a cabinet sized 600 x 2000 x 600

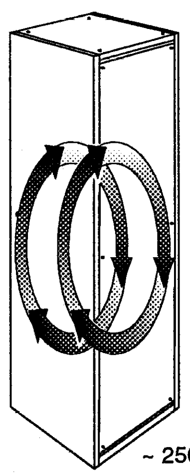
1. CLOSED VERSION

Natural convection



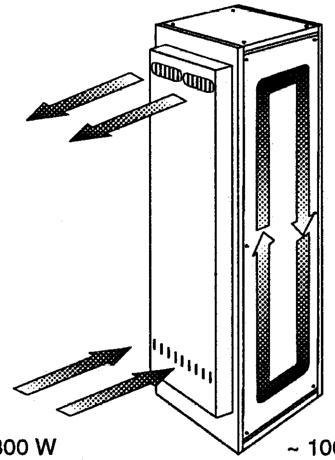
~ 250 -300 W

Forced convection by internal fan (increasing in natural convection)



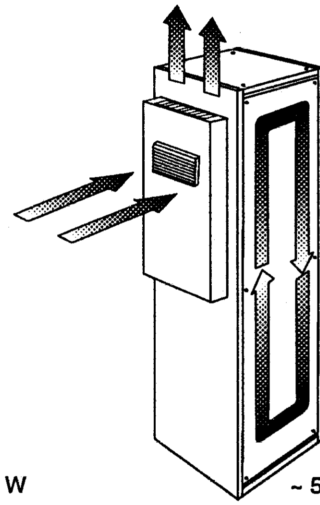
~ 250 - 300 W

Forced air circulation by heat exchanger (air circulation by two separate flows internal and external)



~ 1000 W

Heat dissipation by an air conditioner (cooling by temperature lower than the ambient temperature)

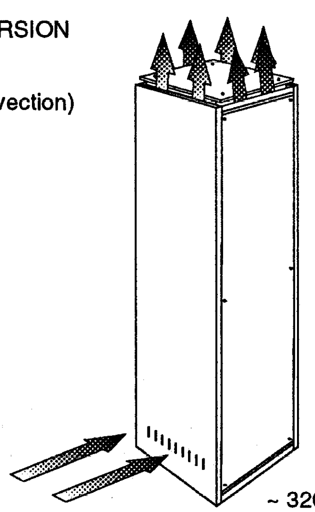


~ 500 W

- Power value dissipated per ΔT = 10 K (single cabinet)
For installation in a row of cabinets, power dissipated in the first two example is decreased of about 15%

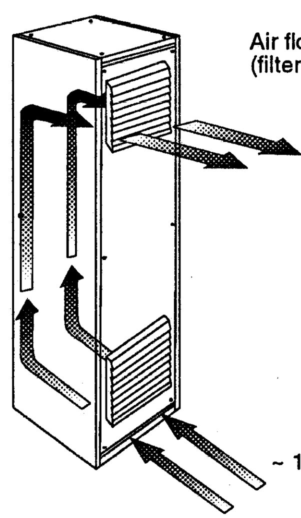
2. OPEN VERSION

Air flow
(Natural convection)



~ 320 - 350 W

Air flow
(filtered fans)

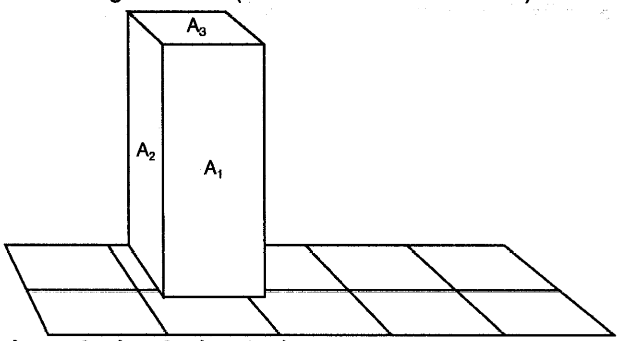


~ 1000 W

- Power value dissipated per ΔT = 10 K (single cabinet)
For installation in a row of cabinet, power dissipated is decreased of about 5-10%

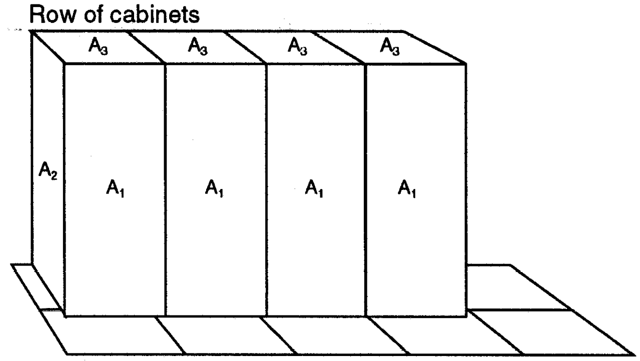
Calculation of radiant surfaces in closed cabinets

Single cabinet (all surfaces free of contact)



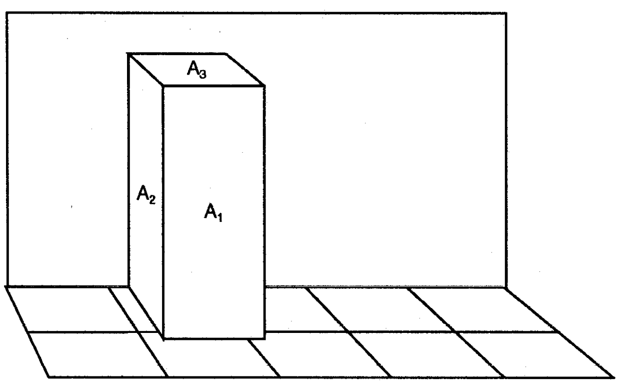
$A_{TOT.} = 2 \times A_1 + 2 \times A_2 + 1 \times A_3$.

Row of cabinets



$A_{TOT.} = 2 \times N \times A_1 + 2 \times A_2 + N \times A_3$.
(N = Number of cabinets placed side by side)

Single cabinet (one side on the wall)



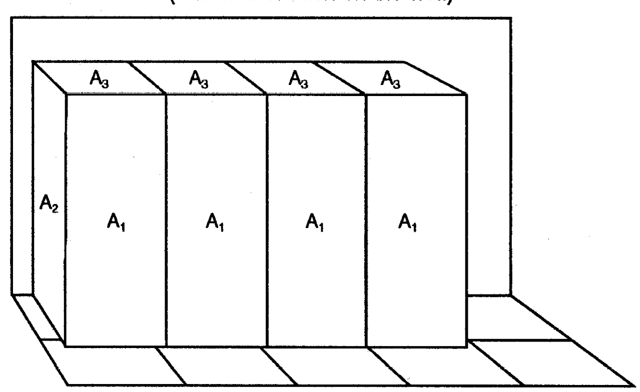
$A_{TOT.} = 1 \times A_1 + 2 \times A_2 + A_3$.
Formula for cabinets with one side on the wall

$A_{TOT.} = 2 \times A_1 + 2 \times A_2 + 1 \times A_3$.
Formula for cabinet with no surfaces in contact with the wall

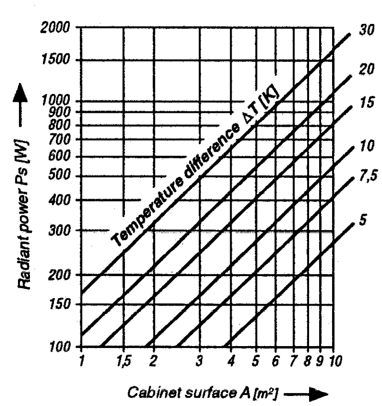
Row of cabinet (one side by the wall)
$A_{TOT.} = 1 \times N \times A_1 + 2 \times A_2 + N \times A_3$.
Formula for row of cabinets with one side on the wall.

$A_{TOT.} = 2 \times N \times A_1 + 2 \times A_2 + N \times A_3$
Formula for row of cabinets with no surface in contact with the wall.

Row of cabinets (one side of each on the wall)



Radiant power dissipation in single cabinet surfaces



7. Electrical connections

7.1 General informations.

Series 1000 instruments are plug-in modular units connected to the termination board by a multipole connector. Therefore, electrical connections (supply, control room, field connections) are made at the termination board unit.
All electrical connections (I.S. circuits and Non I.S. circuits) and wiring should comply with Intrinsic Safety standards and installation rules (i.e. ISA RP 12.6) applicable in the country of installation.
Failure to adhere to these rules can defeat the purpose of I.S. barriers and result in risk of a fire or explosion in Hazardous Location.

7.2 Supply connections.

WARNING !
IMPROPER SUPPLY CONNECTIONS CAN SERIOUSLY DAMAGE THE INSTRUMENT AND RESULT IN RISK OF A FIRE OR EXPLOSION IN HAZARDOUS LOCATIONS!

7.2.1 AC Powered Units (Single module Termination Boards only).

Provide a voltage sectioning device (switch or sect. fuse) on main line for an easy power turn-off when servicing the unit. Connect line conductors at terminals ~ (see Fig. 4e).
Make sure that under no fault circumstances the main voltage can not go higher than the max barrier fault voltage rating of 250 V. Also check that main voltage excursions remain within limits of ± 10% of nominal value.

7.2.2 DC Powered units (Single and multiple module Termination Boards).

D.C. SUPPLY REQUIREMENTS.
Check correct polarity of supply line, making sure that voltage excursions never go lower than 21.5 V (including ripple effect) or higher than 28 V.

WARNING!
Note that a crude, poorly filtered or regulated supply can produce destructive (hundreds of volts) voltage spikes during supply transformer switch off transient; this could cause minor problems to electro mechanical components like relays or solenoids but will surely degrade or destroy electronic equipments.

In case of doubt, provide over voltage limiting by adequately dimensioned surge arresters on primary winding and voltage limiters (power zeners, zenamic etc.) on the dc supply line to limit transients within 30 - 35 V peak.

Supply current capability must be sufficient to provide total worst case current consumption based on values specified for each type of module.
A first approximate assumption can be 50 mA per channel or 100 mA per module (provide margin for expansions).

SUPPLY CONDUCTORS SIZING.
Single units requiring 100 mA will have a conductor sizing based on mechanical strength rather than current carrying capacity.
Eight positions Termination Board requires about 1.6 Amp (fuse rating), so a 1.5 mm^2 (16 AWG) conductor is sufficient.
Sixteen positions Termination Board require about 3.2 Amp (fuse rating), so a 2.5 mm^2 (14 AWG) conductor is sufficient.
Multiple boards have bus arranged supply connections so that only two conductors are required to power up to 32 channels.

A reverse polarity shunt diode and series fuse protection are provided to avoid damaging the modules in case of accidentally reversed polarity connection. In this case, the reverse voltage is clamped at -0.6 V and the T.B. slow blow fuse blows. Restore correct supply polarity, replace the blown fuse with the spare one supplied in the T.B. spare fuse holder (take care to reinstall a good properly sized new spare fuse!).

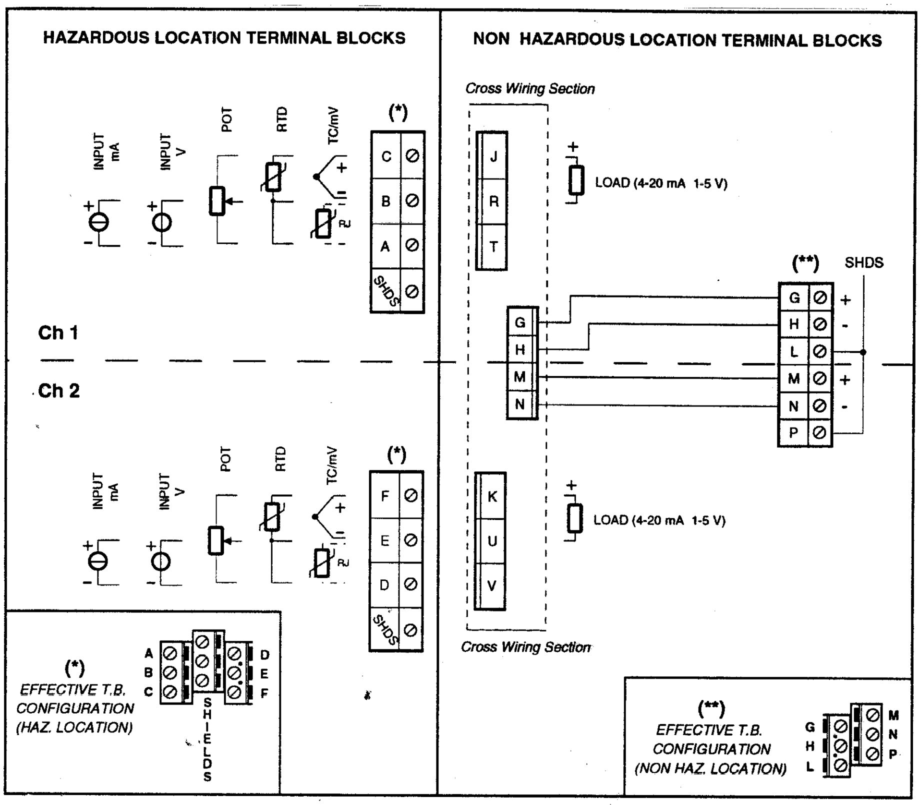
7.3 Control room connections.

Control room circuit (NON HAZARDOUS LOCATION SIDE) connections are made at control room (green) terminals or, for custom boards, at the multipole cable connector.
Be sure to observe signal polarity. Conductor sizing, due to the low currents involved, is based on mechanical strength consideration rather than current density.

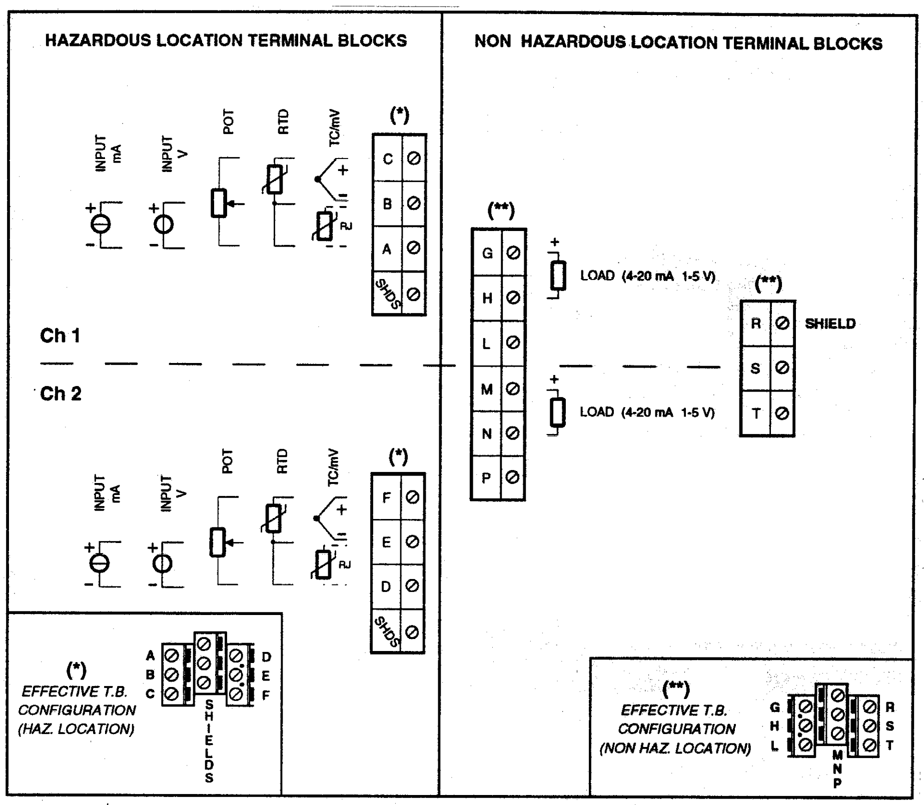
Follow Fig. 4a and 4b for terminals assignment, 4c and 4d for general electrical schematic of termination boards with CW feature, and without CW feature (TB versions) respectively.

See Fig. 4e for single mounting (Model 1101/SM and 1101/SM-AC) Terminal Block Assignment and Layout.

- Fig. 4a -



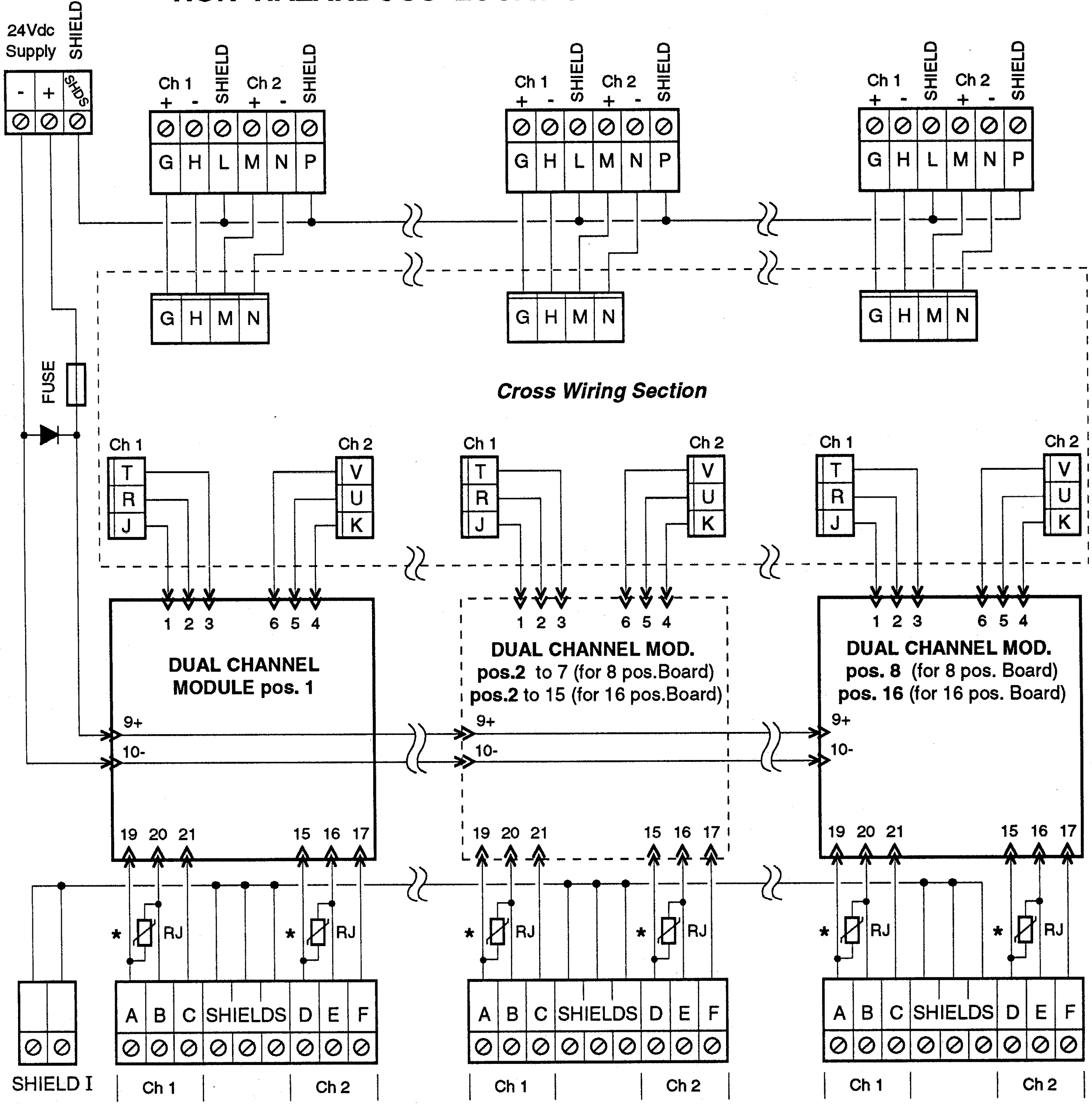
- Fig. 4b -



N O T E : Read warning note at chapter 7.4 when starting connections

- Fig. 4c -

NON HAZARDOUS LOCATION TERMINAL BLOCKS

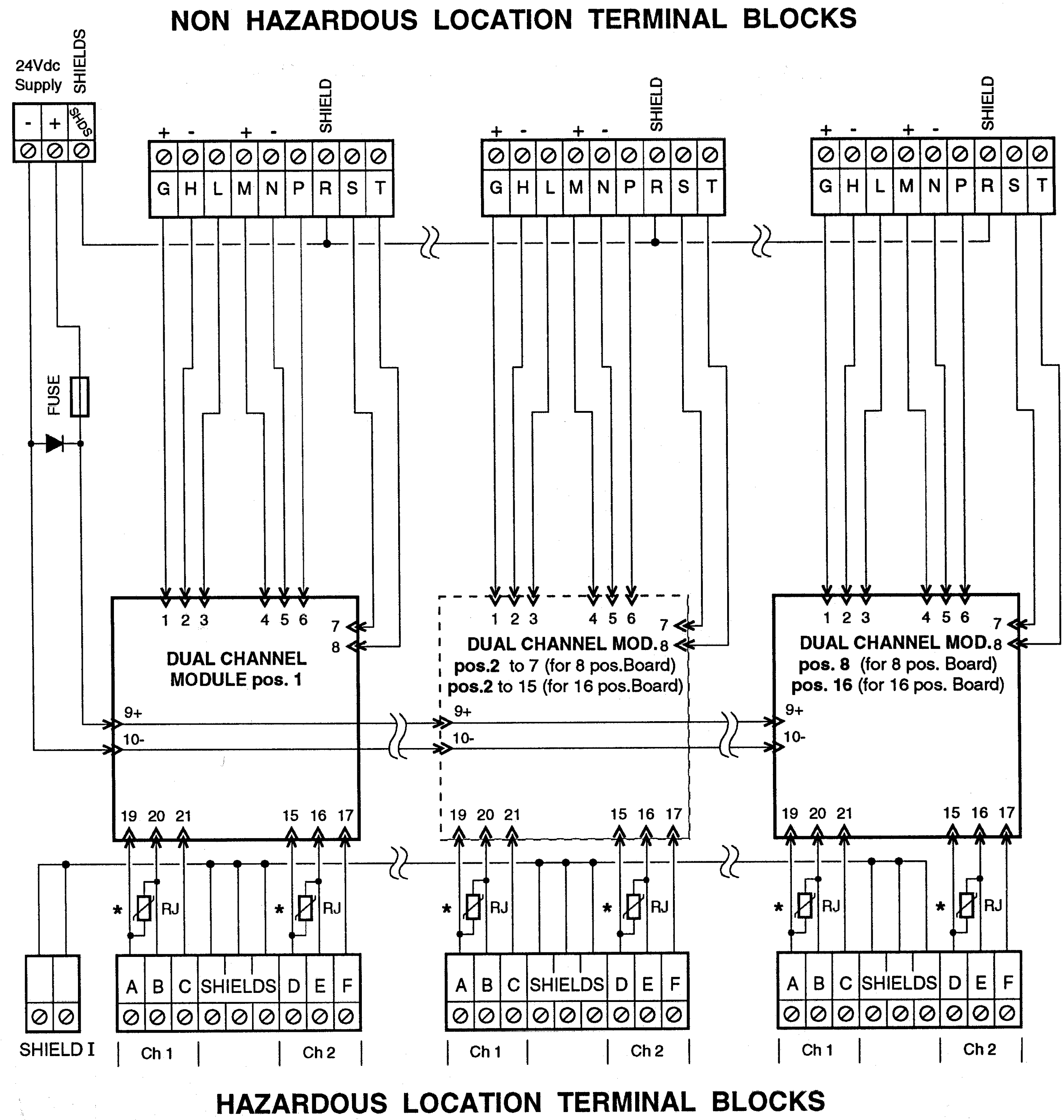


HAZARDOUS LOCATION TERMINAL BLOCKS

* *RJ compensating RTD on Term. Board, only for Models with Thermocouple Input (see chapter 4.3.3 Fig. A and B in this manual for the correct positioning of this component)*

N O T E: Read warning note at chapter 7.4 when starting connections

- Fig. 4d -

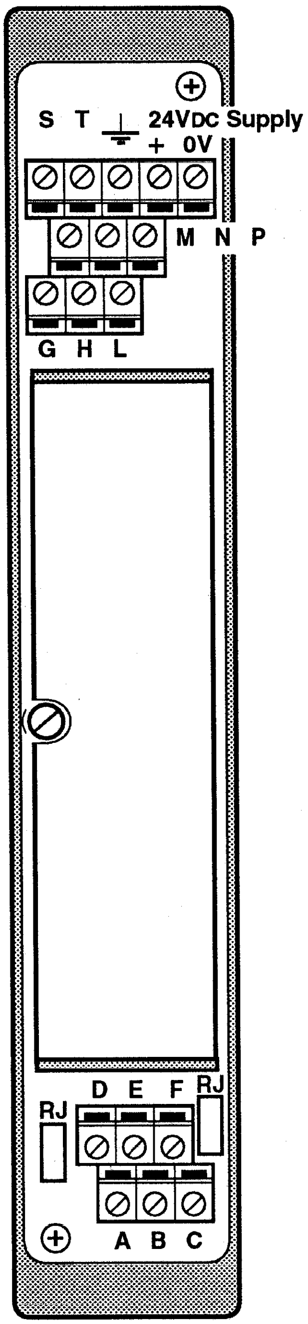


* *RJ compensating RTD on Term. Board, only for Models with Thermocouple Input (see chapter 4.3.3 Fig. A and B in this manual for the correct positioning of this component)*

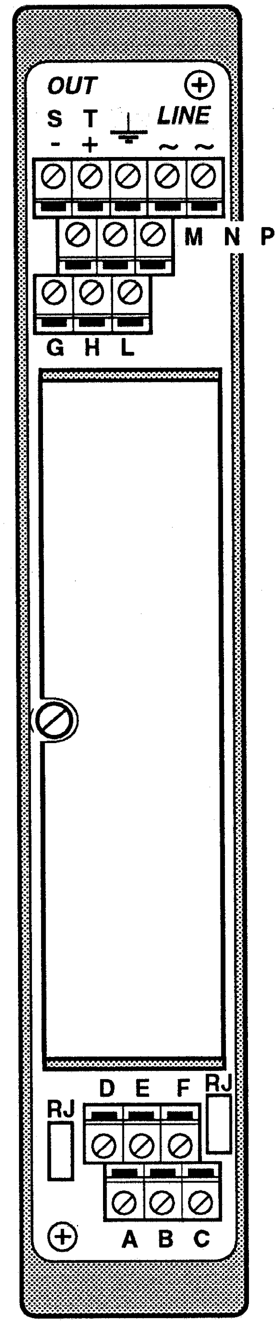
N O T E: Read warning note at chapter 7.4 when starting connections

- Fig. 4e -

NON HAZARDOUS LOCATION TERMINAL BLOCKS



*Layout and TB connections for **1101/SM** Enclosure (24 Vdc Supply)*



*Layout and TB connections for **1101/SM-AC** Enclosure (115-230 Vac Supply)*

HAZARDOUS LOCATION TERMINAL BLOCKS

* *RJ compensating RTD on Term. Board, only for Models with Thermocouple Input (see chapter 4.3.3 Fig. A and B in this manual for the correct positioning of this component)*

N O T E: Read warning note at chapter 7.4 when starting connections

7.4 Field wiring connections.

Field wiring, as all other wiring layout, should comply with I.S. standards as stated in par. 7.1 and 7.8 and will be connected to field terminals (blue) according wiring diagram of Figures 4 (select the effective type). Take care to observe signal polarity and read the recommendations written below.

WARNING!!!!

Please note that Models 1061-62 and 1071-72, temperature acquisition barriers are not intended to operate in a burn-out condition (i.e. temperature sensor disconnected) for extended periods of time. In fact, a burn-out condition produce a substantial unit overheating which, when permanent, significantly reduce the device life. Also when a temporary burn-out condition occurs, one must not neglect the resulting temperature increase for both the burn-out and the other nearby operating barriers. Please note that high temperatures generally relax units specifications and that, after removing the burn-out condition, a certain (possibly long) amount of time is required to get to the normal operating temperature..When a termination board is equipped with a set of unused barriers of these type, it is strongly recommended to short the temperature sensor inputs with proper jumpers. When, for maintenance reasons, some barriers are temporary set in a burn-out condition, the impact of temperature increase are to be taken into account, also for the nearby units.

7.4.1 1011 and 1012 Volt/mA Input.

For type 1011 and channel 1 of dual channel type 1012, input connections must be brought to terminal B (+) and A (-), observing signal polarity and using solid or braided copper conductor of up to 2.5 mm^2 cross section (12 AWG). For channel 2 of 1012 connect to terminals E (+) and D (-) *(See Figure 4 for details).*

Check that terminal screws tight and conductors are well secured with no exposed conductors.

Input shields (if any) should be connected to the SHDS blue terminal. The input shield bus terminal SHIELD I should then be connected to the appropriate grounding point. (see sect. 7.9 "Grounding Information").

7.4.2 1061 and 1062 mV/Thermocouple Input.

Input connections must be brought (according to Figures 4) to terminals C (+) and B (-) for type 1061 and channel 1 of dual channel type 1062. For channel 2 of 1062 connect to terminals F (+) and E (-).

If applicable, input shields should be connected to the SHDS blue terminal. The input shield bus terminal SHIELD I should then be connected to the appropriate grounding point (see sect. 7.9 Grounding Informations).

If the sensor is a thermocouple, connecting wires must be of

- TABLE 8 -
Types of compensating cable and their color coding

TC TYPE	GENERAL STANDARDS FOR CONDUCTORS: BS 4937 / ANSI/ MC 96.1 } Comply with International Standard; DIN 43171 (IPTS - 68)	INTERNATIONAL COLOUR CODING FOR INSULATION OF EXTENSION / COMPENSATING CABLE: BRITISH *To BS 1843*	AMERICAN *To ANSI/MC 96.1*	GERMAN *To DIN 431710-4*
E	BS 4937 part 6 ANSI Type E (replaces circular 561) DIN 43710	SHEATH : *BROWN* POSIT. (+) : *BROWN* NEG. (-) : *BLUE*	SHEATH : *VIOLET* POSIT. (+) : *VIOLET* NEG. (-) : *RED*	
T	BS 4937 part 5 (replaces BS 1828) ANSI Type T (replaces circular 561) DIN 43710	SHEATH : *BLUE* POSIT. (+) : *WHITE* NEG. (-) : *BLUE*	SHEATH : *BLUE* POSIT. (+) : *BLUE* NEG. (-) : *RED*	SHEATH : *BROWN* POSIT. (+) : *RED* NEG. (-) : *BROWN*
V	Meets BS 4397 part 5 & approximates to BS 4397 part 4 up to 80°C	SHEATH : *RED* POSIT. (+) : *WHITE* NEG. (-) : *BLUE*		SHEATH : *GREEN* POSIT. (+) : *RED* NEG. (-) : *GREEN*
K	BS 4937 part 4 (replaces BS 1827) ANSI Type K (replaces circular 561) DIN 43710	SHEATH : *RED* POSIT. (+) : *BROWN* NEG. (-) : *BLUE*	SHEATH : *YELLOW* POSIT. (+) : *YELLOW* NEG. (-) : *RED*	SHEATH : *GREEN* POSIT. (+) : *RED* NEG. (-) : *GREEN*
J	BS 4937 part 3 (replaces BS 1829) ANSI Type J (replaces circular 561) DIN 43710	SHEATH : *BLACK* POSIT. (+) : *YELLOW* NEG. (-) : *BLUE*	SHEATH : *BLACK* POSIT. (+) : *WHITE* NEG. (-) : *RED*	SHEATH : *BLUE* POSIT. (+) : *RED* NEG. (-) : *BLUE*
R	BS 4937 part 2 (replaces BS 1826) ANSI Type R (replaces circular 561) DIN 43710	*THERE ARE NO STANDARD SPECIFIED COLOURS for R & S PRECIOUS METAL EXTENSION CABLE* *NB.: SEE COMPENSATING CABLE CODE U BELOW*		
S	BS 4937 part 1 (replaces BS 1826) ANSI Type S (replaces circular 561) DIN 43710			
U *	Approximates to BS 4397 part 1 & 2 up to 50°C	SHEATH : *GREEN* POSIT. (+) : *WHITE* NEG. (-) : *BLUE*	SHEATH : *GREEN* POSIT. (+) : *BLACK* NEG. (-) : *RED*	SHEATH : *WHITE* POSIT. (+) : *RED* NEG. (-) : *WHITE*

★ *CABLES : Compensating alloy combination for interconnecting. Type R & S thermocouples & instrumentation.*

the same type of metal as the thermocouple or compensating cable. In so doing, no thermoelectric junction will be present, thus creating stray signals as a function of the cable temperature. Obviously **its important not to interchange the compensated cable conductors**.

Since they are made of dissimilar metals, they would produce spurious thermoelectric junction with consequent drifts in the measurement. Table 8 gives the relevant information on compensating cables and their conventional color coding in different countries. Note that some countries' coding contradicts with other countries' coding practice.

In case of doubt on the thermoelectric emission polarity, you can use a magnet to distinguish iron from constantan or nickel from nichrome. A simple polarity detection method, applicable to all types of T.C. metals, consists in creating a thermoelectric junction with the unknown wires (just twist together the two exposed conductors) and heat with a match while observing the thermoelectric emission and its polarity with a millivoltmeter at the other cable end.

Note that the first metal named in each TC pair is always the positive [i.e. Iron - Const = Iron (+) Const (-)].

7.4.3 1071 and 1072 Resistance Temperature Detector (RTD) / Transmitting Potentiometer Input

RTD Input.

Input terminals are A, B, C for type 1071 and for channel 1 of type 1072. For channel 2 of type 1072 input terminals are D, E, F (See Figures 4 for details).

Note that conductors of terminals A and B (D and E for chan. 2) should be connected together at the RTD sensor end for line resistance compensation.

Input line resistance can range from 0 to 6 Ohms for each of the three conductor without appreciably affecting measuring accuracy (provided the three conductor resistances are balanced within at least ± 5%).

You can also connect the RTD with two wires only by jumpering terminals A, B (D, E) together. In this case however, the line resistance and its associated change with cable temperature fluctuation will directly add to the sensor resistance causing some measuring error. Note that a 0.385 Ohm change of Sensor Resistance corresponds to 1°C of temperature change.Input shields (if any) should be connected to the SHLD blue terminal. The input shield bus terminal SHIELD I should be connected to the appropriate grounding point (see sect. 7.9 Grounding Information).

Transmitting Potentiometer Input.

Input terminals are A (Pot low end) B (wiper) C (Pot high end) for type 1071 and for channel 1 of type 1072. For chan. 2 of type 1072 they are D, E, F, respectively.

The potentiometer resistance can range from 50 to 10000 Ohms, but its nominal value must be specified when ordering to account for it in the calibration. Input shields (if any) should be connected to the SHLD blue terminal. The input shield bus terminal SHIELD I should be connected to the appropriate grounding point (see sect. 7.9 Grounding Information).

7.5 Output connection.

The output is connected at terminals G (+) and H (-) for single channel types (J and R on cross wiring terminal for CW versions) and for channel 1 of dual channel types. For channel 2 of dual channel output terminals are M (+) and N (-) note that the electronic circuit limits the max output to about 120% of full scale in case of input overload. The output circuit is protected by a 50 mA internal fuse to preserve the Intrinsic Safety in case of severe overload. In the case of improper connections at the output (i.e. line supply wires inadvertently connected at the output terminals), the consequent overloading fault current (I_F >> 50 mA) will blow the 50 mA fuse interrupting the output circuit. In this case the fuse must be replaced (resoldered) and the integrity of the output circuit carefully checked for component faults before putting the converter back to operation. The maximum output load is 500 Ohms for a 4-20 mA output. All loads must be connected in series so that the current flowing out of terminal G can pass through all loads and return back into terminal H.

For voltage outputs, connect the resistances in parallel to the output. Load resistances must be higher than 250 KΩ to maintain the output loading error within 0.1% (the output impedance is 250 Ohm). Output shields (if any) should be connected to terminal R (L and P for TB with CW feature) (SHIELD) of green terminal blocks.

7.6 Intrinsically safe system.

An Intrinsically Safe system is composed by an assembly of intrinsically safe apparatus,associated apparatus and interconnecting cables,where the following definitions apply:

- *Simple Electrical Apparatus*
  Apparatus in WHICH NEITHER OF THE FOLLOWING ELECTRICAL PARAMETERS ARE EXCEEDED: 1.2 V 0.1 A (Generated) 20 µJoules (Stored) 25 mW (Dissipated), in this case the Apparatus does not require any certificate or labeling.
  (Typical examples can be Thermocouples, Resistance Temperature Detectors, Contacts, Strain Gauges, Light Emitting Diodes, photocells).

- *Intrinsically Safe Apparatus*
  Apparatus in which all circuits are intrinsically safe. It must have suitable approval for the hazardous (classified) location where it will be mounted and must have a control drawing that specifies safety parameters: Vmax.; Imax.; Ci; Li. (i.e. Proximity Switches, Transmitters, Active Sensors, magnetic pick-up) must be Intrinsically Safe Certified.

- *Associated Apparatus*
  Apparatus in which circuits may affect the energy in the intrinsically safe circuits to which it is connected.
  It must have suitable approval for connection to devices in the hazardous (classified) location.
  Associated apparatus safety parameters are specified as : **Voc ; Isc ; Ca ; La .**
  They must appear on the label (U max may not be on the

label, normally is 250 V).
Typical examples of Associated Apparatus are:
Zener (shunt diode) Barriers,Galvanically isolated Analog Barriers, Intrinsically Safe Signal Converters, Intrinsically Safe Contact/Proximitor Repeaters, Solenoid Valve Actuators Intrinsically Safe Data Loggers etc.
Types 1011/1012, 1061/1062, 1071/1072 are associated apparatus which must be installed in non hazardous location interfacing simple electrical apparatus (sensors) with control room equipment.
Associated apparatus and control room equipment shall not be powered or generate any voltage greater than 250 Volts.

7.7 System design considerations.

The system must be evaluated under the "entity concept" where the following rules apply:
To determine acceptable combination of intrinsically safe apparatus and connected associated apparatus the following conditions must be valid:

$$V_{max.} > V_{oc}$$
$$I_{max.} > I_{sc}$$

The length of interconnecting cable shall be determinate in accordance with the maximum allowed parameters by the associated apparatus according to the expression:

$$C_{cable} \leq C_a - C_i$$
$$L_{cable} \leq L_a - L_i$$

Table 9 shows the max allowed safety parameters of these models.
NOTE: For installation, refer to chap. 7.8.

7.8 Wiring of intrinsically safe circuits.

Installation shall be in accordance with Intrinsic Safety standards and installation rules (eg. ANSI/ISA RP 12.6), applicable in the Country where the application is made.
Intrinsically safe circuits shall be so identified.Color coding may be used for identification if the color used is light blue and no other wiring is color coded light blue. Other identification means may be for example: signs,tags,markings which shall be visible after installation.

Wiring of intrinsically safe circuits shall be positively separated from non intrinsically safe wiring (such as power wiring) by one of the following methods:

- Using separated raceway
- Providing an insulating or grounded metal partition
- Spacing of at least 50mm and separately tied down

Different intrinsically safe circuits shall not be run in the same multiconductor cable unless at least 0.25mm thick insulation is used on each conductor.
Cables, raceways or conduits used to contain intrinsically safe circuits must not transmit flammable atmosphere from hazardous to non hazardous location. Otherwise they must be sealed or vented.

ENTITY PARAMETERS

Safety Description Voc = 13.1 V Isc = 26 mA				
TERMINALS	**Capacit. Ca (µF)**	**Inductance La (mH)**	**GROUPS USA**	**CENELEC**
C - B F - E (C-B-A and F-E-D for type 1071/72)	1.1	47	A - B	II C
	3.3	180	C - E	II B
	8.8	400	D - F - G	II A

- TABLE 9 -

7.9 Grounding informations.

Grounding of intrinsically safe circuits IS NOT REQUIRED when connected to associated apparatus like Series 1000 Instruments having galvanic isolation between intrinsically safe circuit and all the other circuits.
Should grounding be necessary, for functional reasons, only one point of the intrinsically safe circuit must be grounded.
In case of using shielded cables, proper shield grounding (if needed) shall be provided at one point only.
Metallic enclosures of field devices and Termination Board must be grounded.

8. Operating instructions

8.1 Introduction.

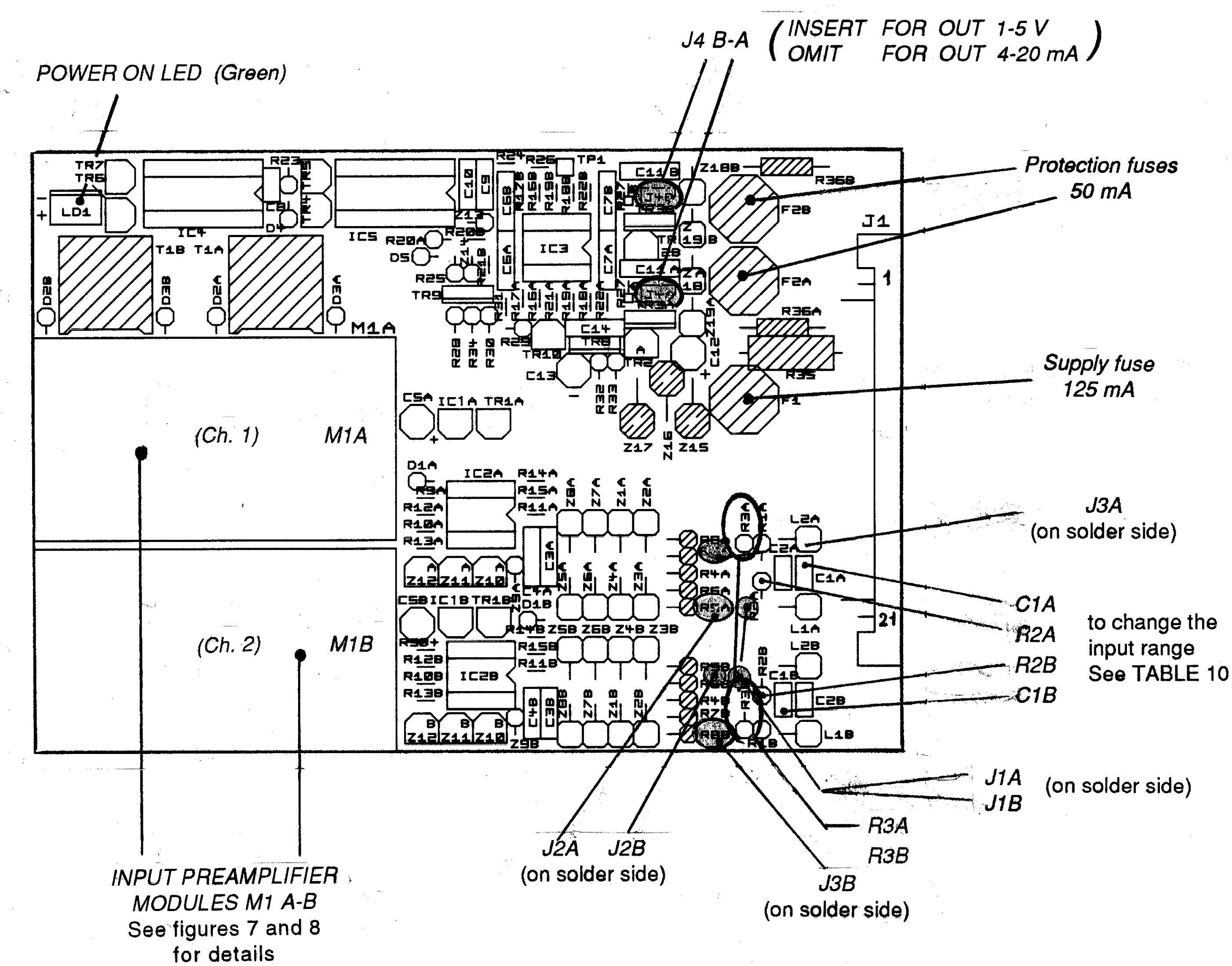
Series 1000 barrier modules, like other Elcon Instruments apparatus, do not require any particular adjustment since they are thoroughly factory calibrated and configured according to order specifications.

8.2 Preliminary checks.

Before putting the barrier module into operation and powering it check the following:

On termination Board
- Supply connection, voltage value, polarity (DC supply).
- Field wiring connection, polarity, cable routing and separation from non I.S. conductors, cable capacitance and inductance, cable TAGS.
- Control room wiring, polarity, TAGS.
- Cross-wiring connections (if any) and polarity, TAGS.

On Barrier Module
- Module type consistency with what is required.
- Output form consistency with actually required type of signal (i.e. 4-20 mA or 1-5 V)
  (Check data on side label of the module).



- Fig. 5 -

Note that on the barrier card for each channel a programmable jumper J4 A-B (see Fig. 5) allows shunting the current output with a precision 250 Ohms resistor that changes the 4-20 mA output into a 1-5 V voltage drop output (in this case J4 A-B must be closed).

If preliminary checks give no evidence of problems, barrier module can be powered and put into operation.

9. Calibration instruction

9.1 Introduction.

All Series 1000 barrier modules are designed for long term stable and trouble free operation. They have been factory calibrated after a 100 hour burn-in period at 55°C (131°F) using high accuracy, periodically certified, traceable standard calibrators operating under computer control to perform an automated Final Testing Procedure and Test data recording. Therefore they should not require, under normal operating circumstances, any calibration check or readjustment.

9.2 Equipment required.

In case a calibration check or readjustment is necessary the following equipment is required:

A) 4 1/2 digit DMM (Digital Multi Meter)
Ranges 20 V Resolution 1 mV Accuracy 0.1% or better
Ranges 20 mA Resolution 10 µA Accuracy 0.1% or better

B1) *1011/1012*
Current/voltage calibrator Range 0-20 mA Resolution 10 µA accuracy ± 0.1% with voltage compliance of 20 V or more