

*Analog Fire Alarm
Control Panel*

AM-6000

Installation Manual



NOTIFIER ITALIA

A Division of Pittway Corporation

INDEX

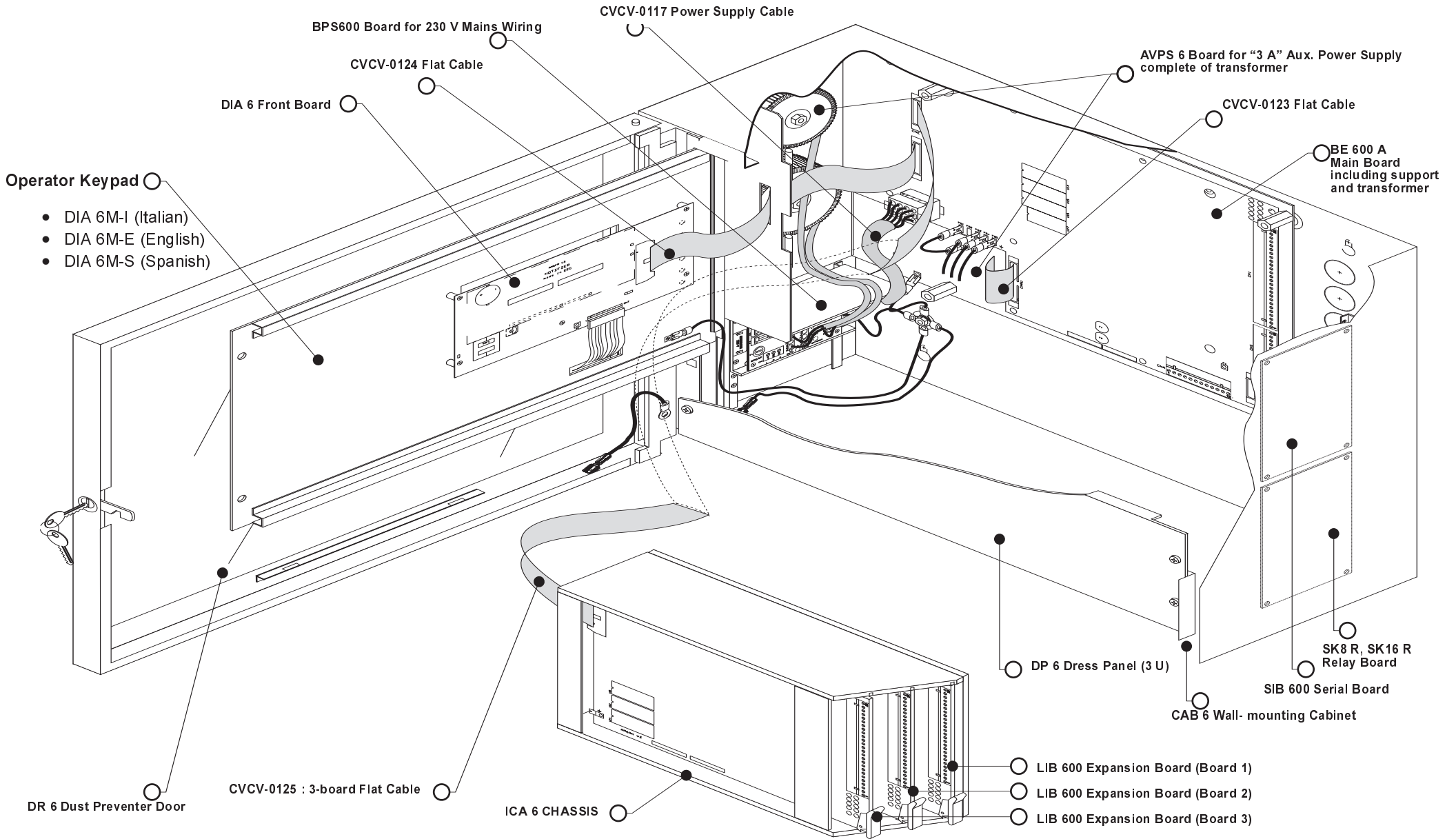
» This new revision, B.2, includes an Appendix on page 27 about “AM-6000 Power Supply”.

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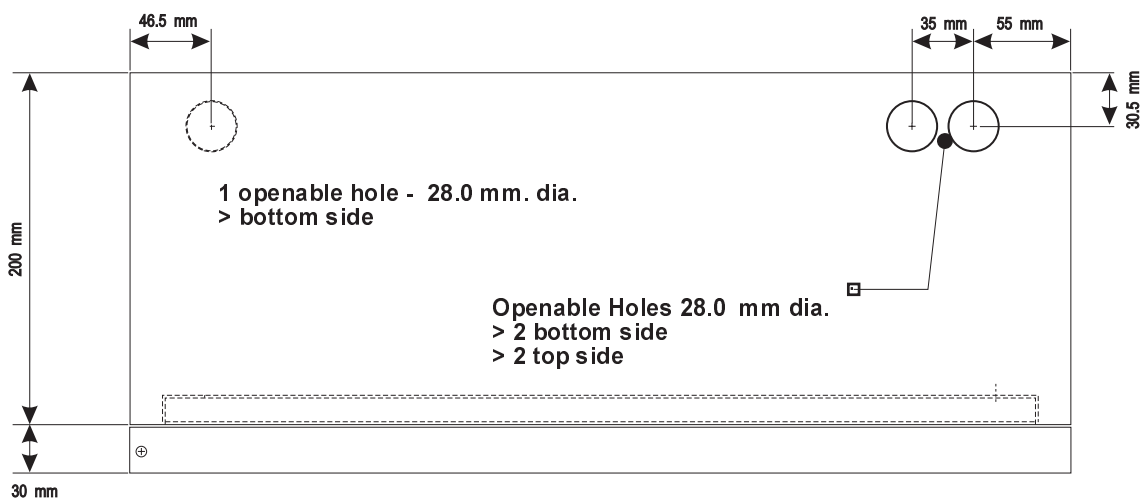
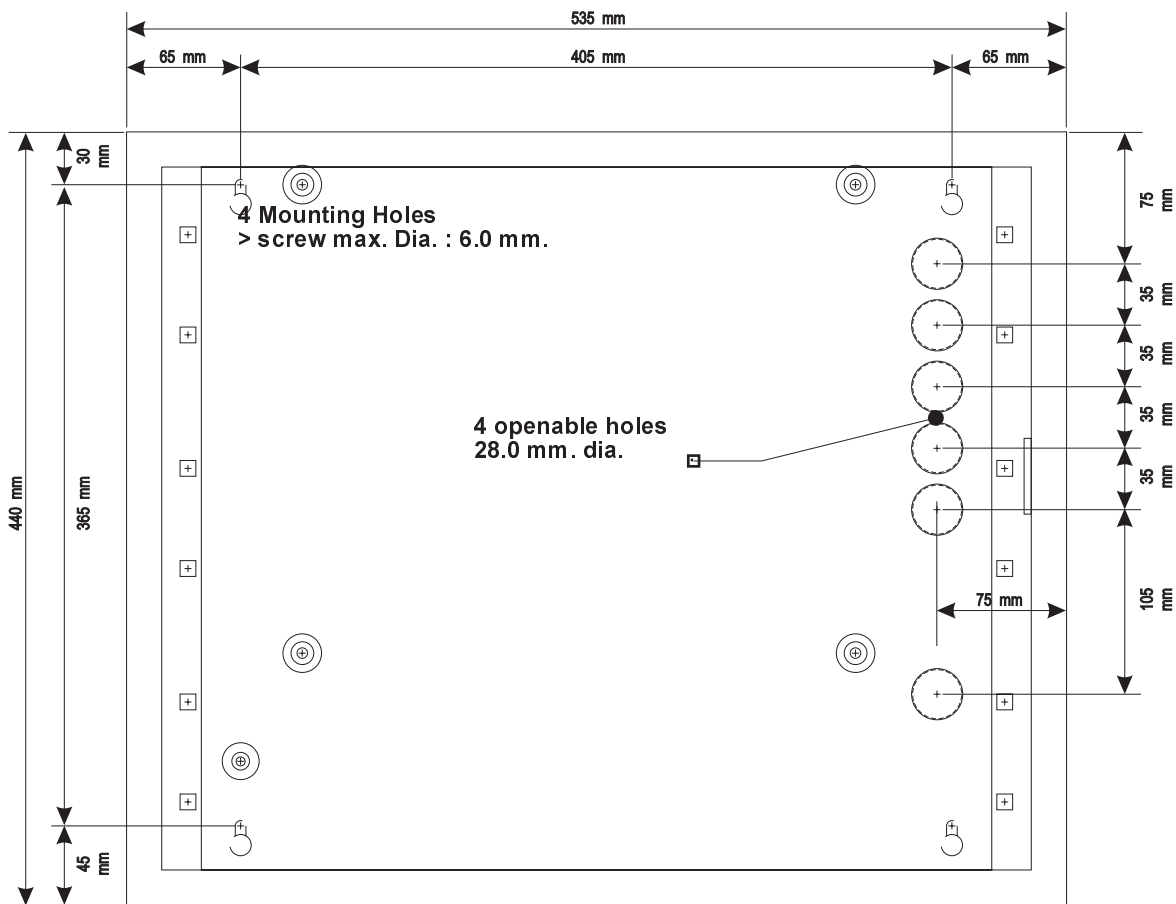
APPENDIX: AM-6000 POWER SUPPLY (Refer to note 1)

Note 1: Added in this new revision

AM-6000 EXPLODED VIEW

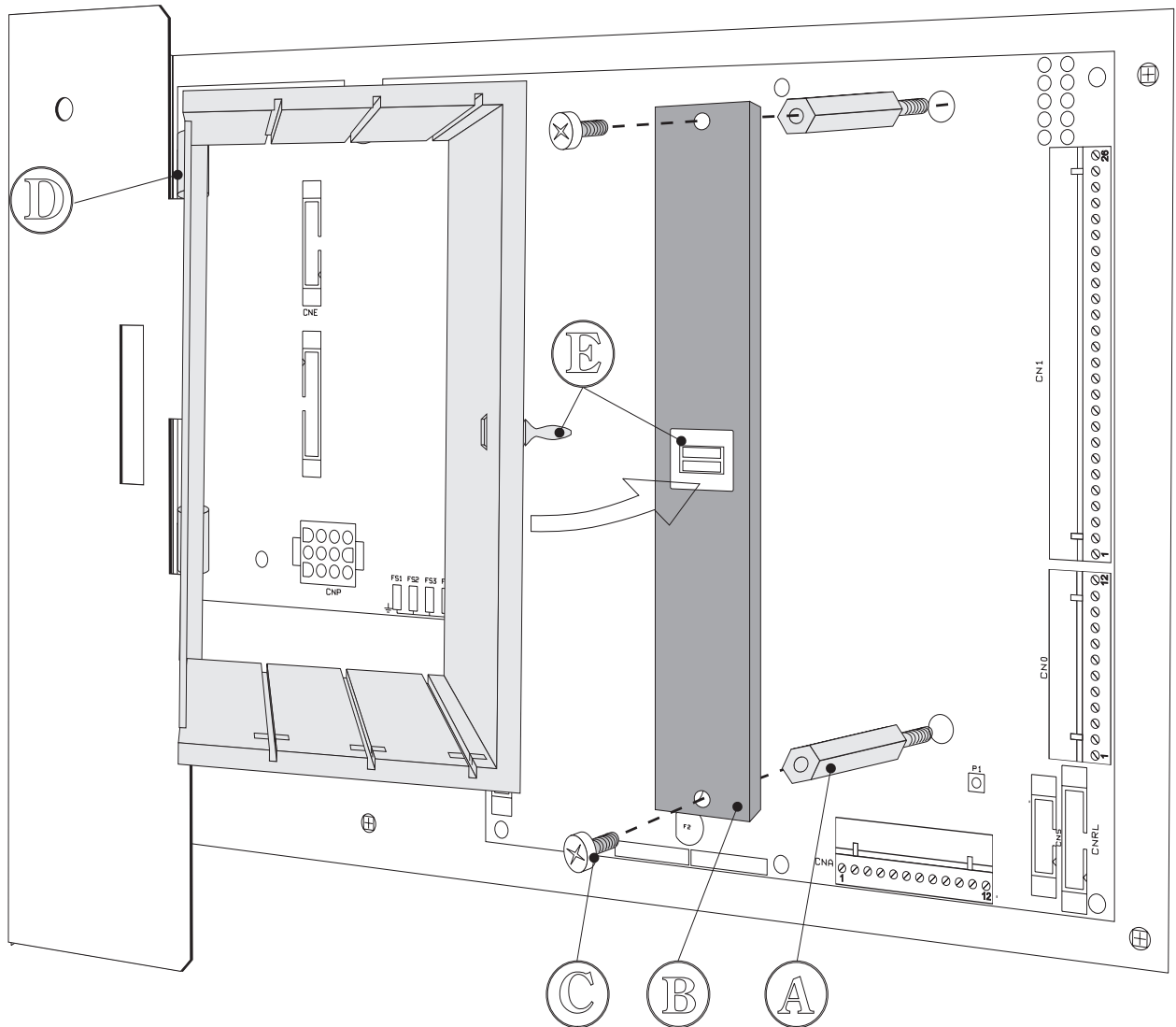


CABINET



Dust preventer door

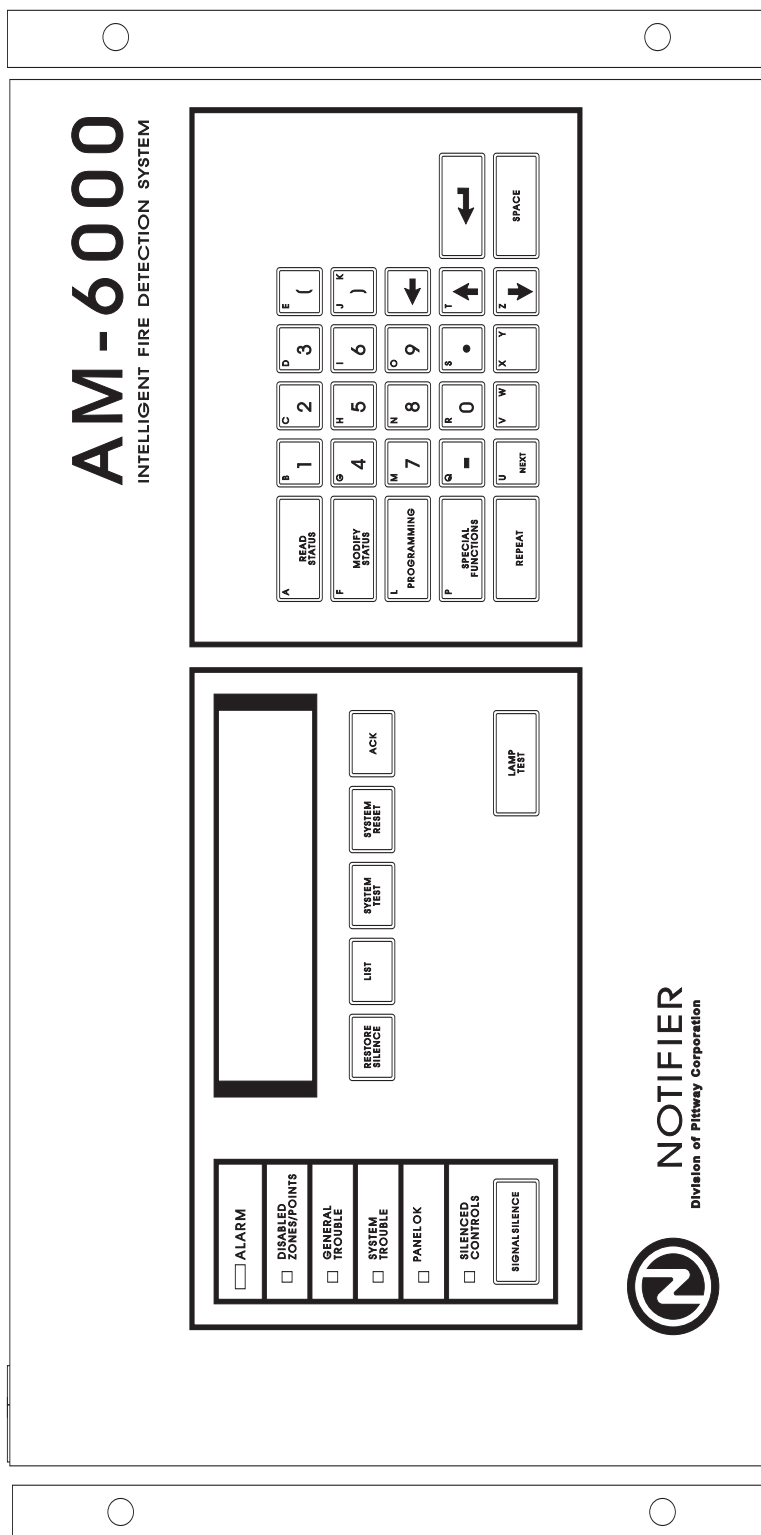
MOUNTING THE SYSTEM BOARDS to the "ICA-6" CHASSIS



INSTALLING THE ICA-6 CHASSIS

- 1 - Screw the two spacers 4 x 45 MF (A) to the plate.
- 2 - Secure the metal plaque (B) with the two screws 4 x 8 TC (C).
- 3 - Insert the chassis on the proper hinges (D). Then push the chassis inward toward the bottom of the cabinet. A "click" will confirm the correct seat of the chassis (E).

FRONT PANEL INDICATION & KEYPAD

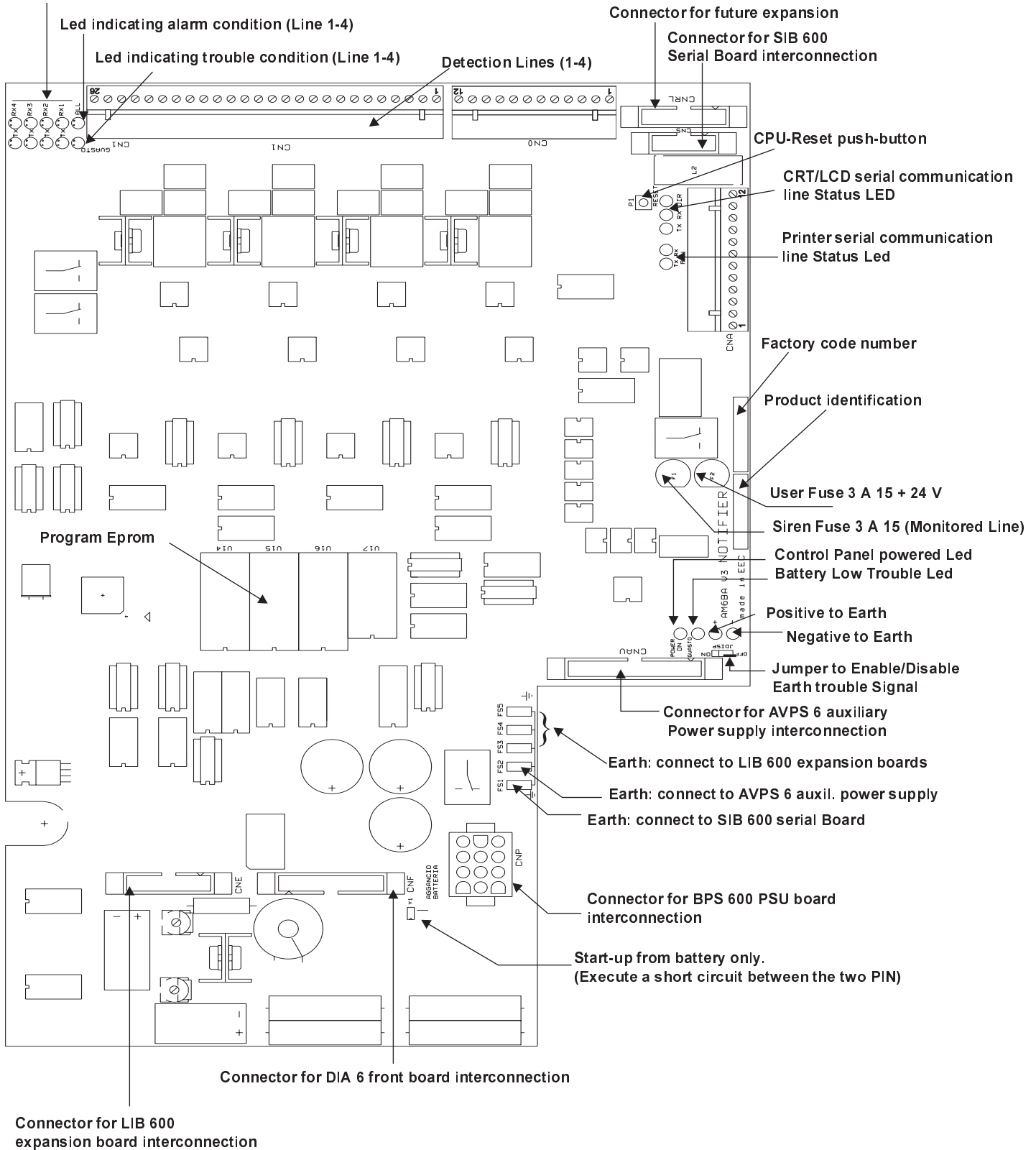


DIMENSIONS

- Front panel including the hinge = 482 x 266 mm (19" - 6 units).
- Mounting holes wheel-base : Horizontal = 465 mm. - Vertical = 190 mm.

"BE-600 A" MAIN BOARD LAYOUT

4 Status Leds concerning the detector line serial communication



CONNECTOR CNA on "BE-600 A" BOARD

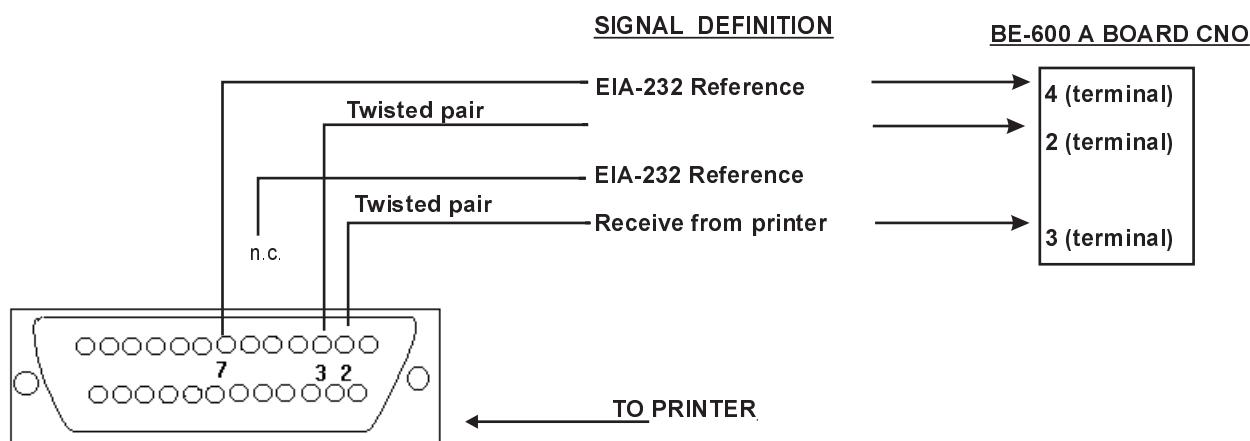
TERMIN. NR.	DENOMINATION	NOTE	USE FOR :	CABLE COLOUR/NR.
1	+ 24 V User	0,5		
2	GND P	2 A		
3	+ 24 V User Resettable	0,5	ISOLATED BY MANUAL RESET	
4	GND P	2 A		
5	Siren Supervis.Line+(Stand by)	3 A		
6	Siren Supervis.Line -(Stand by)			
7	SIGNAL SILENCE		N.O. CONTACT	
8	RESET		N.O. CONTACT	
9	+ 24 V Auxiliary	3 A	ONLY IF AVPS 6 IS INSTALLED	
10	GND P		ONLY IF AVPS 6 IS INSTALLED	
11	+ 24 V Aux. Resettable	3 A	ONLY IF AVPS 6 IS INSTALLED	
12	GND P			

CONNECTOR CN0 on "BE-600 A" BOARD

TERMIN. NR.	DENOMINATION	NOTE	USE FOR :	CABLE COLOUR/NR.
1	GROUND			
2	RS 232 TX - PRN		PRINTER 2400 Baud 7 BIT Parity : EVEN 1 BIT STOP	
3	RS 232 RX - PRN			
4	GND IS			
5	RS 232 TX	(*)	CRT-TERMINAL FOR EXTERNAL PROGRAMMING (CRT/PC TERM.)	
6	RS 232 RX			
7	GND IS			
8	RS 485 LIN + (OUTWARD)	(*)	LCD-6000 REPEATERS	
9	RS 485 LIN - (OUTWARD)			
10	GND IS			
11	RS 485 LIN + (RETURN)			
12	RS 485 LIN - (RETURN)			

NOTE: (*) these two outputs CANNOT operate simultaneously. The operator must select the Type of Connection to employ, from the Control Panel Main Programming Menu (refer to AM-6000 Programming Manual).

SERIAL PRINTER CONNECTIONS



Plug the DB-25 connector into the EIA-232 port of the printer

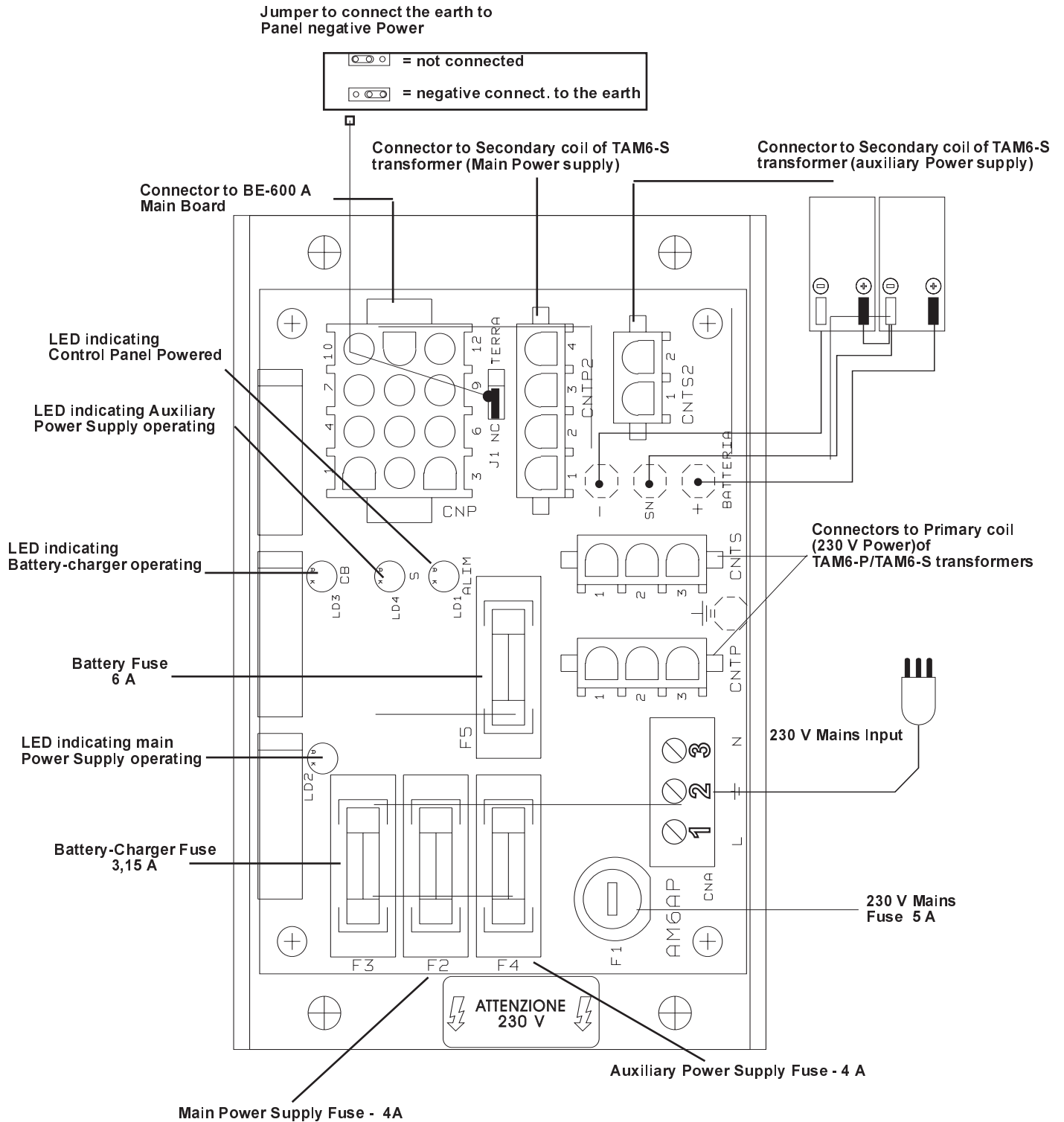
CONNECTOR CN1 on "BE-600 A" BOARD

TERMINAL NUMBER	DENOMINATION	NOTE	LINE ID.	CABLE COLOUR/NUMBER
1	A1 +	(1)	DETECTOR LINE 1	
2	A1 -			
3	B1 +	(1)		
4	B1 -			
5	SC 1	(2)		
6	A2 +		DETECTOR LINE 2	
7	A2 -			
8	B2 +			
9	B2 -			
10	SC 2			
11	A3 +		DETECTOR LINE 3	
12	A3 -			
13	B3 +			
14	B3 -			
15	SC 3			
16	A4 +		DETECTOR LINE 4	
17	A4 -			
18	B4 +			
19	B4 -			
20	SC 4			
21	ALARM RL - N.O.	(3) 3 A 30 VDC		
22	ALARM RL - COM			
23	ALARM RL - N.C.			
24	TROUBLE RL - N.O.			
25	TROUBLE RL - COM			
26	TROUBLE RL - N.C.			

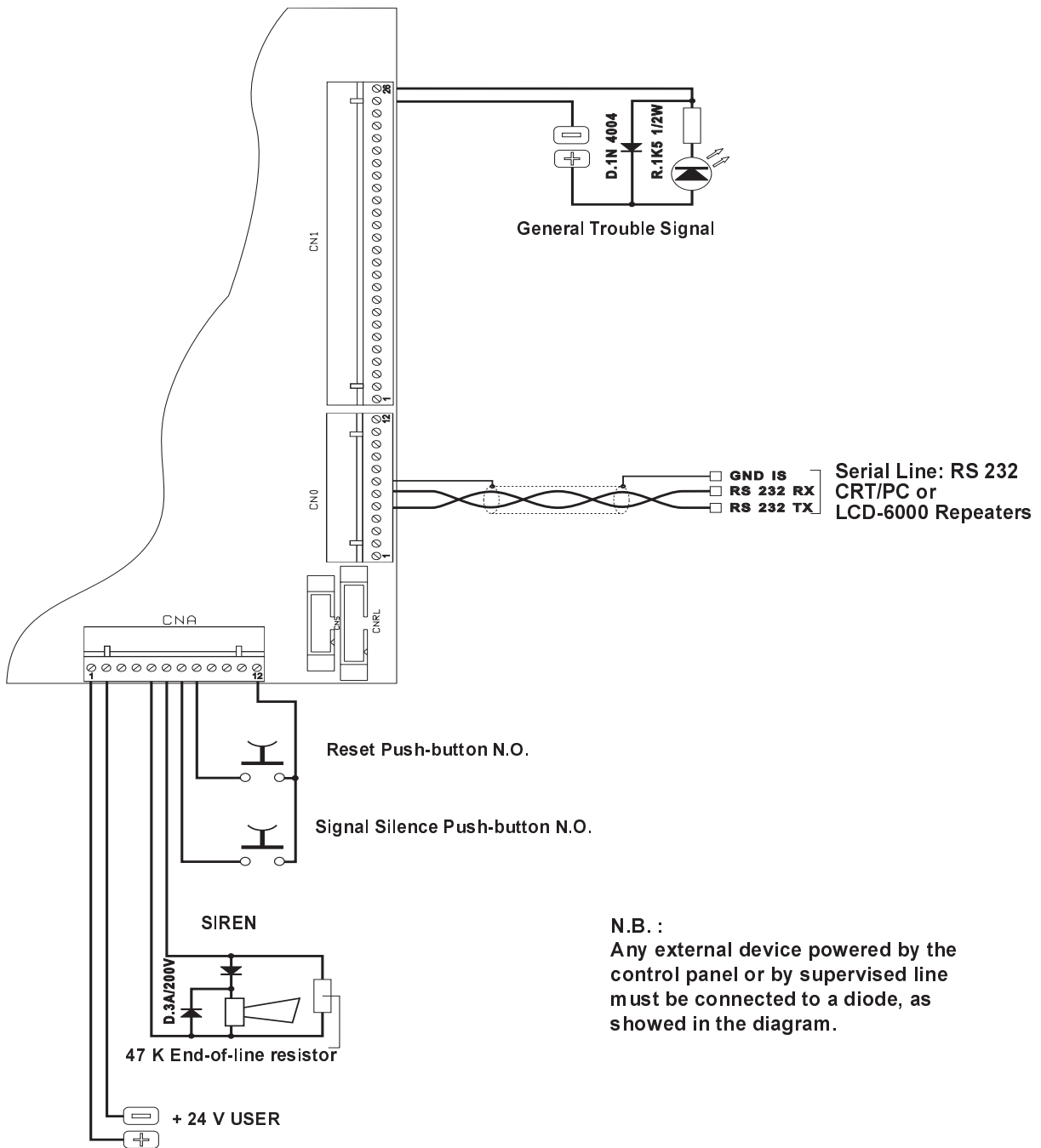
» NOTE :

- 1) If a line is programmed as Style 6 (loop line), terminals A are the OUTWARDS and terminals B are the RETURN.
- 2) For each line connect the shield to appropriate SC terminal.
- 3) Alarm and Trouble Controls : free voltage contacts.
Use to drive loads in DC only.
Alarm is activated if a detector of line 1-4 is in ALARM condition.
Trouble is activated if a detector of line 1-4 is in TROUBLE condition.

"BPS-600" BOARD for 230 V MAINS WIRING

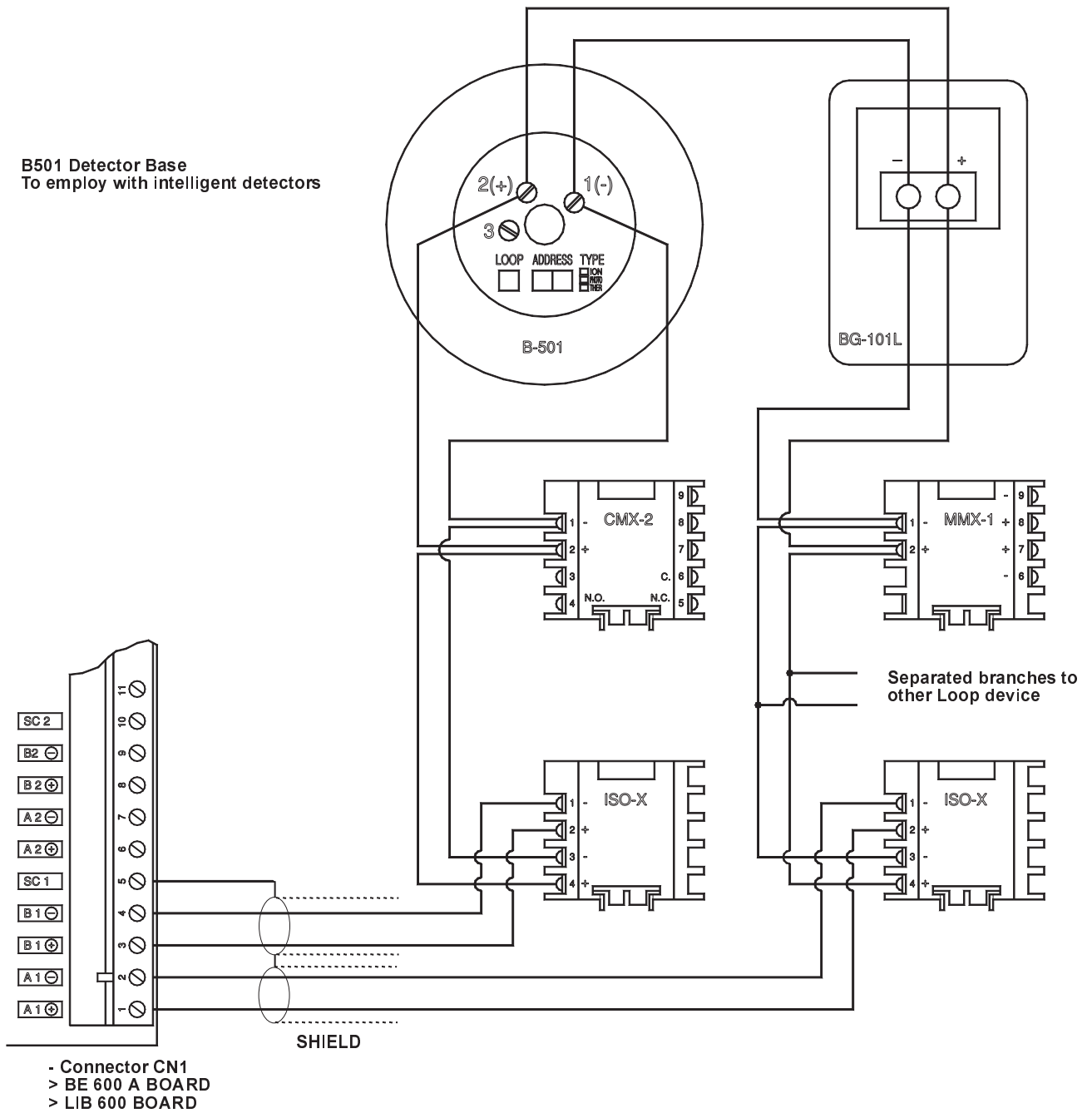


WIRING THE "BE-600 A" MAIN BOARD EXTERNAL DEVICES

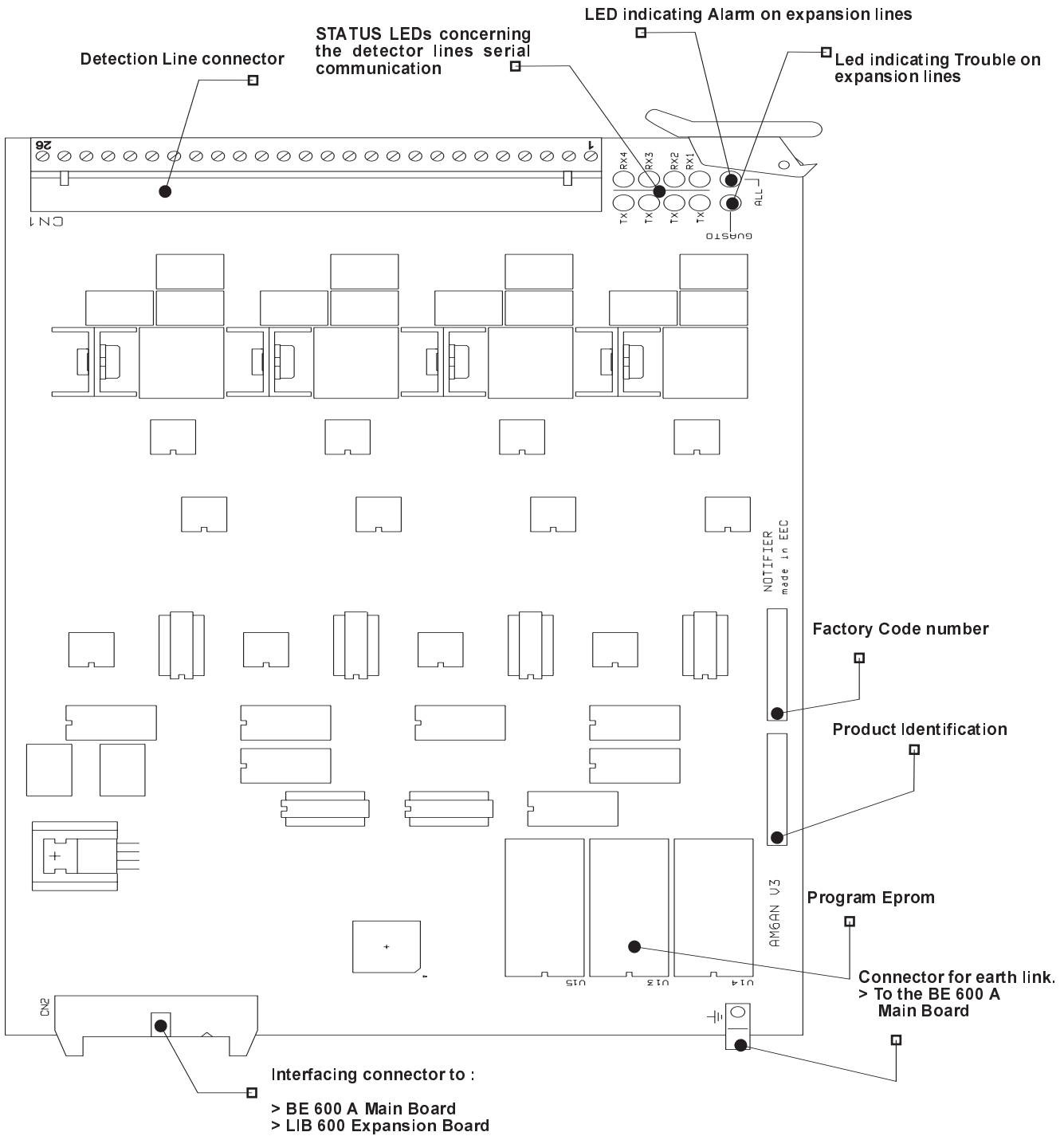


DETECTOR AND MODULE WIRING

Typical LOOP line (style 6)



"LIB-600" EXPANSION BOARD LAYOUT



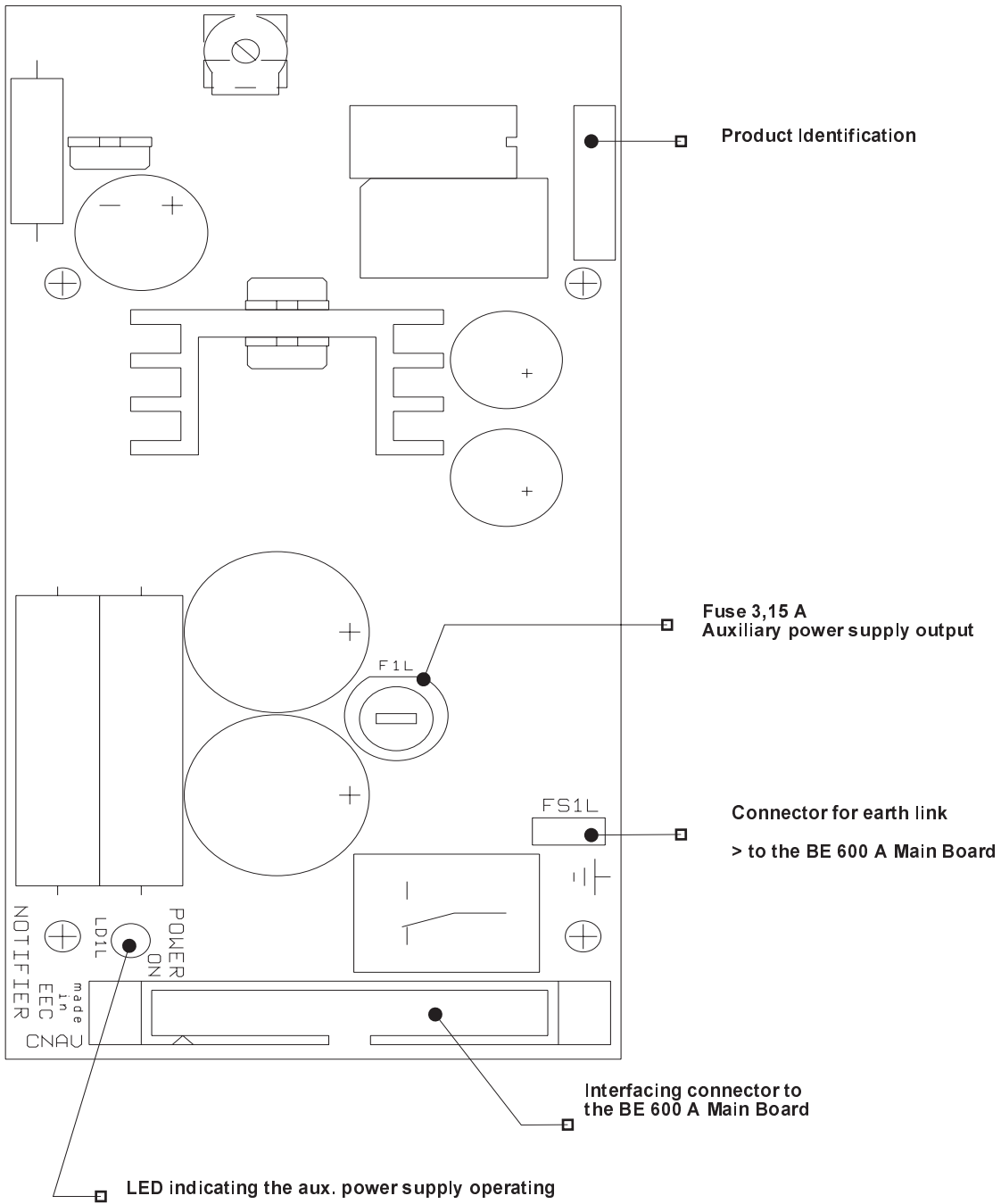
CONNECTOR CN1 on "LIB-600" EXPANSION BOARD

TERMINAL NUMBER	DENOMINATION	NOTE	LINE ID. BOARDS			CABLE COLOUR/NUMBER
1	A1 +	(1)				
2	A1 -		LINE	LINE	LINE	
3	B1 +	(1)	5	9	13	
4	B1 -		BOARD	BOARD	BOARD	
5	SC 1	(2)	1	2	3	
6	A2 +					
7	A2 -		LINE	LINE	LINE	
8	B2 +		6	10	14	
9	B2 -		BOARD	BOARD	BOARD	
10	SC 2		1	2	3	
11	A3 +					
12	A3 -		LINE	LINE	LINE	
13	B3 +		7	11	15	
14	B3 -		BOARD	BOARD	BOARD	
15	SC 3		1	2	3	
16	A4 +					
17	A4 -		LINE	LINE	LINE	
18	B4 +		8	12	16	
19	B4 -		BOARD	BOARD	BOARD	
20	SC 4		1	2	3	
21	ALARM RL - N.O.	(3)				
22	ALARM RL - COM					
23	ALARM RL - N.C.	3 A				
24	TROUBLE RL - N.O.	30 V				
25	TROUBLE RL - COM					
26	TROUBLE RL - N.C.					

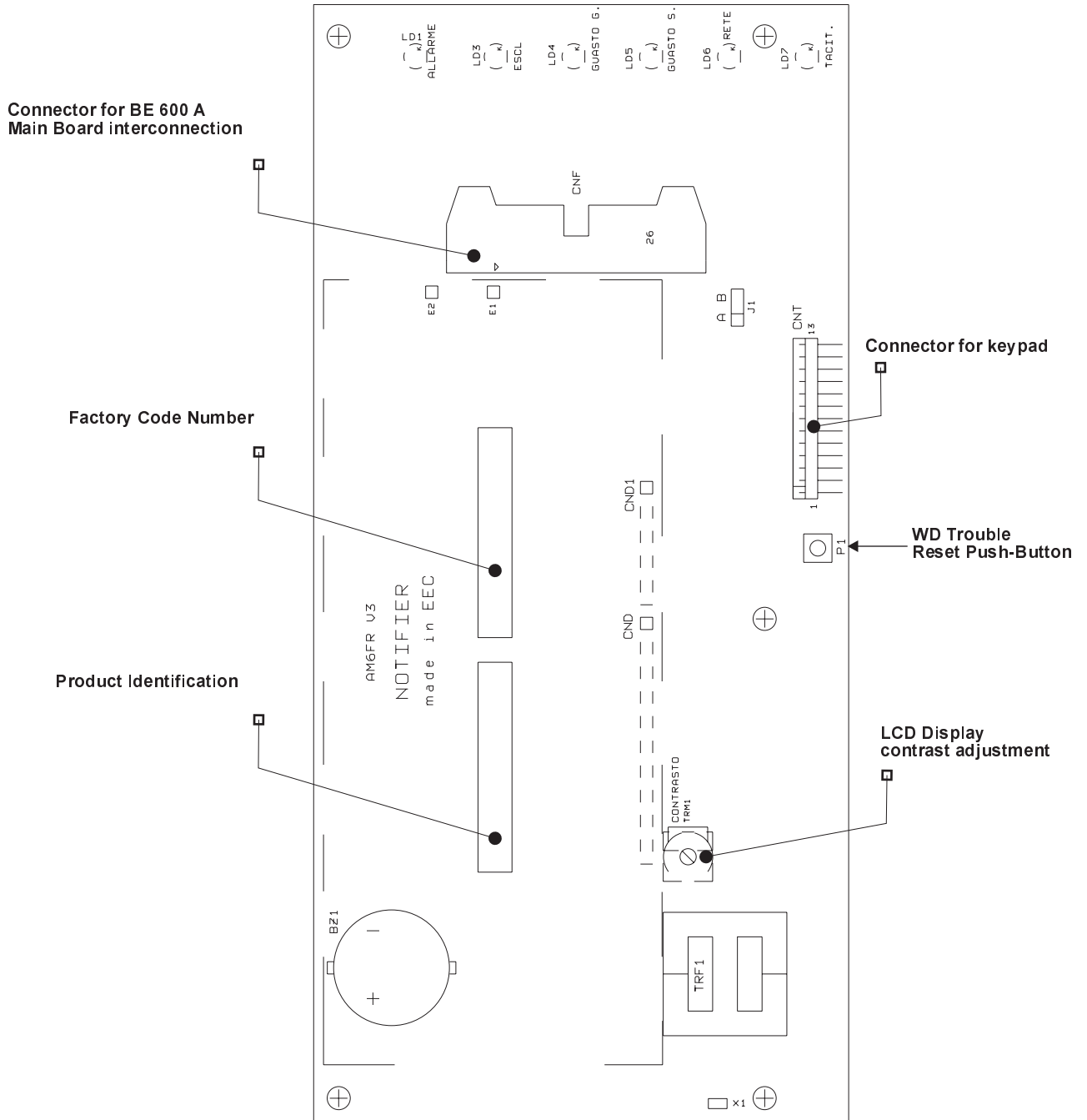
» NOTE :

- 1) If a line is programmed as Style 6 (loop line), terminals A are the OUTWARDS and terminals B are the RETURN.
- 2) For each line connect the shield to appropriate SC terminal.
- 3) Alarm and Trouble Controls : free voltage contacts.
Use to drive loads in DC only.
Alarm is activated if a detector of line 1-4 is in ALARM condition.
Trouble is activated if a detector of line 1-4 is in TROUBLE condition.

"AVPS-6" AUX. POWER SUPPLY BOARD



“DIA-6”:FRONT PANEL DISPLAY and KEYPAD INTERFACE LAYOUT



ANALOG IDENTIFICATION SYSTEM COMPONENTS

DETECTOR and MODULE COMMUNICATION LINES

The AM-6000 System communicates with intelligent and addressable, monitor and control devices through a 2-wire line. The lines can be wired to meet the requirements of an NFPA STYLE 4, STYLE 6 or STYLE 7. The peripheral devices are powered using the same line as for data communication.

ISOLATOR MODULES

Isolator Modules (ISO-X) permit a group of devices and modules to be electrically “isolated” from the remainder of the SLC Loop, allowing critical loops components to operate even in case of a short circuit of the communication line.

MONITOR MODULES

Addressable Monitor Modules (MMX), allow the AM-6000 to monitor N.O. contacts, alarm initiating devices, manual pull stations, 4-wire conventional smoke detectors, heat detectors, water-flow and supervisory devices.

CONTROL MODULES

Through addressable Control Modules (CMX), the AM-6000 can selectively activate notification appliance circuits or FORM-C (Voltage free contacts) output relays.

INTELLIGENT DETECTORS

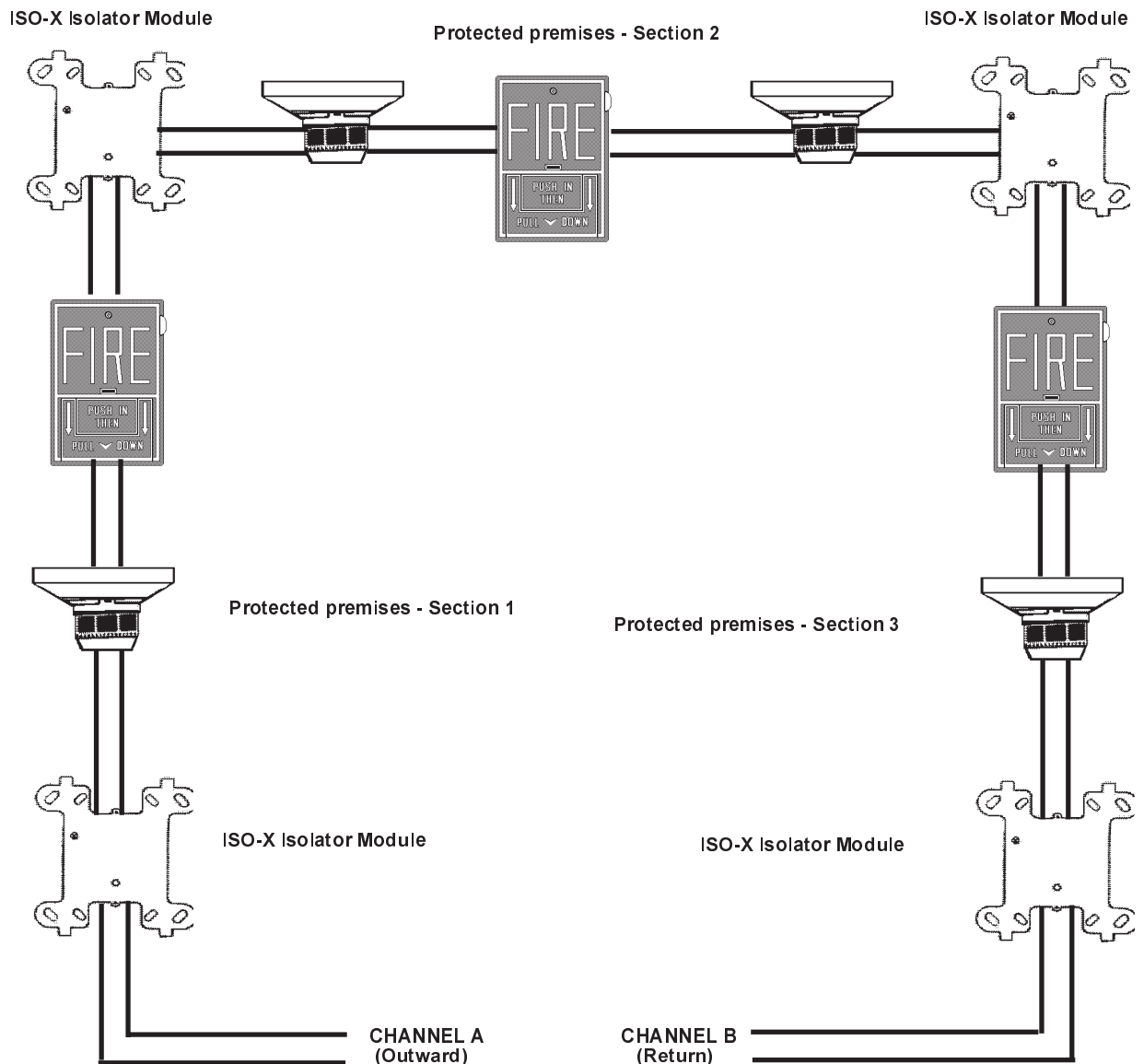
The AM-6000 can communicate with intelligent ionization, photoelectric, thermal and Rate-of-Rise detectors.

LOOP INTERFACE EXPANSION BOARD (LIB 600)

The capacity of each LIB-600 board consists of up to 4 lines. Each line can support up to 99 intelligent detectors, and any combination of max. 99 addressable pull stations, and control and monitor modules. The AM-6000 is able to support a maximum of three LIB-600 boards for a total of 16 lines (4 lines on the main board and 12 on the 3 LIB-600 boards).

CLASS “A” WIRING CIRCUIT AND LINE ISOLATORS

Functions in accordance with NFPA STYLE 7 Signaling Line Circuit



» **Note: the number of addressable devices between ISO-X modules must not exceed 25 devices.**

OPERATION

By separating each group of SLC Loop devices, with a pair of ISO-X Trouble Isolator Modules, each device is protected from opens and short circuits on all other sections.

For instance, a trouble on Section 2 will not affect Section 1 and 3.

The Isolator Modules on either side of Section 2 will open the SLC Loop. Section 1 will still operate from power on Channel “A”, and Section 3 will operate from Channel B.

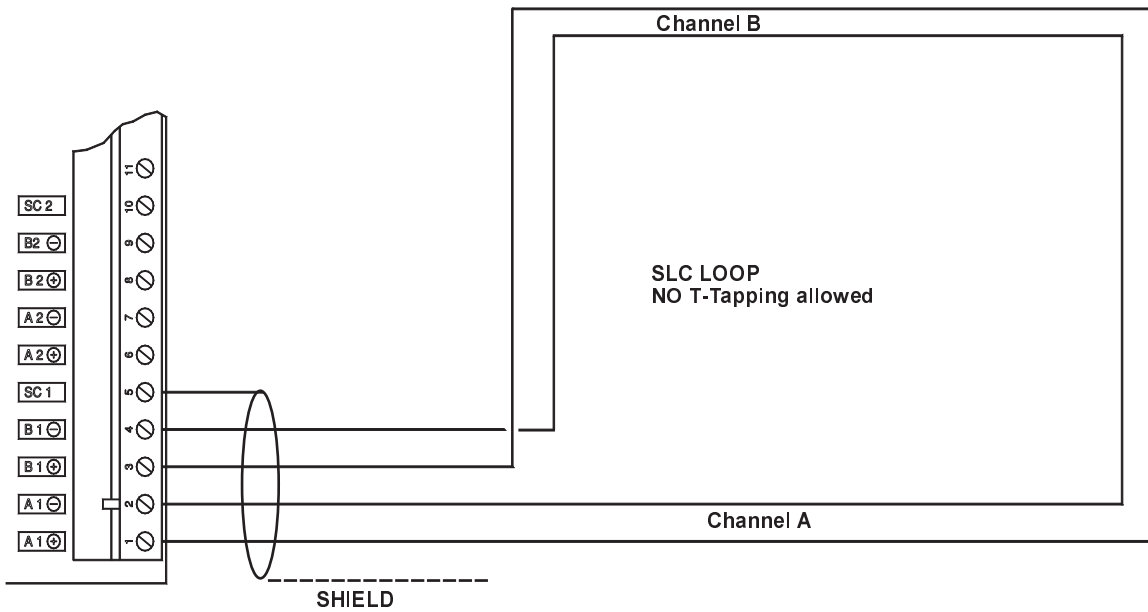
Since the control panel will no longer be able to communicate with the SLC Loop devices on Section 2, a trouble signal will be generated (“INVALID REPLY” from Section 2 Points).

This circuit is a variation of an NFPA Style 6 Signaling Line Circuit, therefore no T-Tapping or branching is allowed.

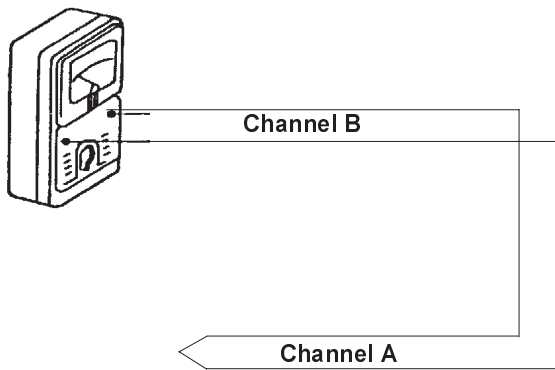
The ratings and characteristics are the same as for the Style 6 circuit.

NOTES ABOUT LOOP WIRING

CLASS "A" WIRING



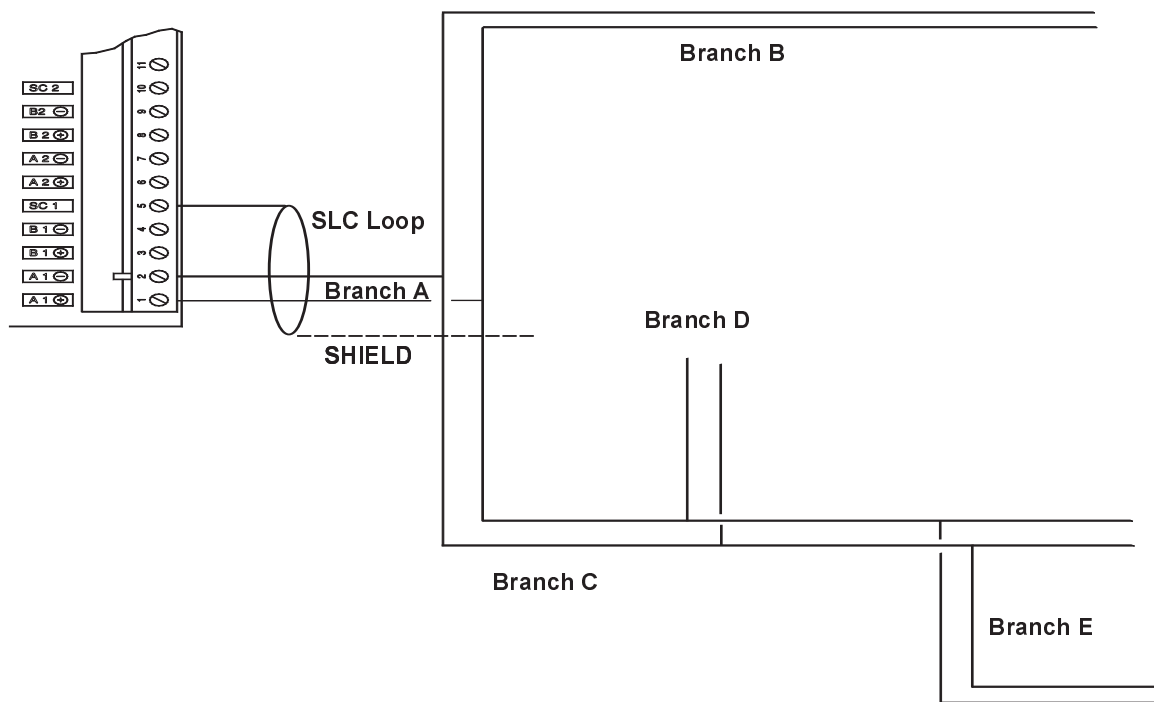
Total length of the SLC Loop pair (from the control panel output and back to the control panel) **CANNOT exceed** 3000 meters.



The DC Resistance of the SLC Loop pair **CANNOT exceed** 40 Ohm.

The measurement must be made by disconnecting Channels A and B at the control panel, shorting the two leads of Channel A together, and metering the two leads of Channel B.

CLASS "B" WIRING

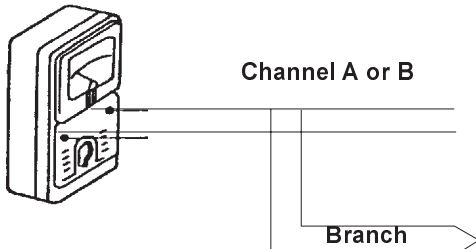


BRANCH RESISTANCE

Short the termination point of one branch at a time and measure the DC resistance, from the beginning of the channel to the end of that particular branch.

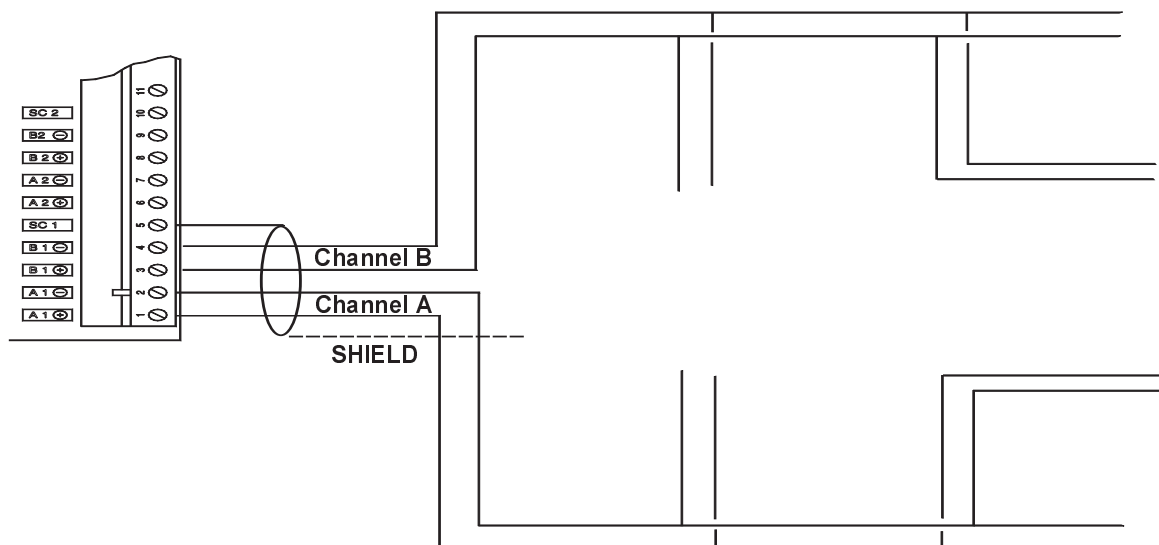
The total DC resistance from panel to branch end **CANNOT** exceed 40 Ohm.

Repeat the procedure for all remaining branches.



For each channel:

Add the lengths of all branches. The **TOTAL CANNOT** exceed 3000 mt.
 $(\text{Branch A}) + (\text{Branch B}) + (\text{Branch C}) + (\text{Branch D}) + (\text{Branch E}) \leq 3000 \text{ meters}$



The total of all branches on Channel B **CANNOT** exceed 3000 meters.

The total of all branches on Channel A **CANNOT** exceed 3000 meters.

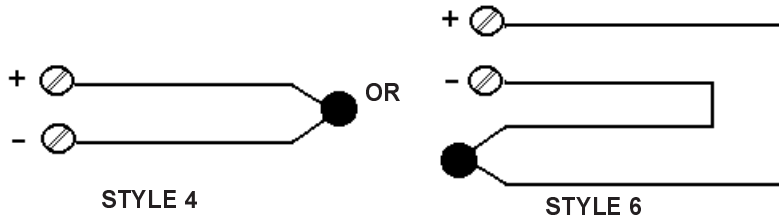
ANALOG SYSTEM LINES TEST PROCEDURE

- ❑ Before powering the control panel lines, verify the following values:

» NOTE : DIGITAL VOLTAGE METER NEEDED

a) Line Resistance

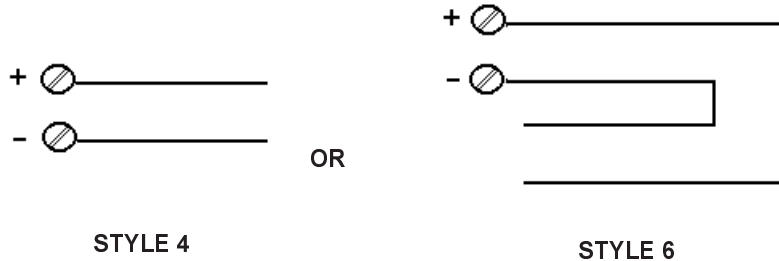
Short positive and negative of one end of the system. Place tester probes on the (+) and (-) sides of the line.



The resistance CANNOT exceed 40 Ohm.

b) Line Isolation

Remove the prior short circuit. Place the tester probes on the positive (+) and negative (-) sides of the line with detectors or modules installed, and verify as follows:



b1)

Connect :

Tester (+) / Line (+) and Tester (-) / Line (-)

Verify :

Resistance: 1 - 1.3 MOhm

b2)

Connect :

Tester (+) / Line (-) and Tester (-) / Line (+)

Verify :

Resistance: 0.7 - 0.9 MOhm

c) Line and Cable Shield Isolation

Place one probe of the tester on the line wire shield and the other one on the positive (+) side of the line. The resistance MUST exceed 15 - 20 MOhm, better if "infinite". Perform the same procedure between the shield and the negative (-) side of the line, and verify that the resistance exceed 15-20 MOhm.

d) Line and System Earth Isolation

Place one probe of the tester on the System Earth and the other one on the positive (+) side of the line.

The resistance MUST exceed 15 - 20 MOhm, better if "infinite". Perform the same procedure between earth and the negative (-) side of the line, and verify that the resistance exceed 15-20 MOhm.

e) Cable Shield and System Earth Isolation

Place one probe of the tester on the System Earth and the other one on the shield. The resistance MUST exceed 15 - 20 MOhm, better if "infinite".

f) Line Voltage

When the detector/module line is connected, the LIB output voltage (terminal 1 - 3) must be 24 VDC without device polling (no Points programmed).

A voltage lower than 14 VDC, indicates a polarity inversion on at least one device.

CABLE REQUIREMENTS

Type of cable: 2-conductor TWISTED-SHIELDED cable.

Sections concerning the line total length (for the line "STYLE 6", the operator must consider the loop length) which CANNOT exceed 3000 meters and whose resistance must be lower than 40 Ohm.

Example:

- Up to 500 mt. - cable 2 x 0.5 mm²
- Up to 1.000 mt. - cable 2 x 1 mm²
- Up to 1.500 mt. - cable 2 x 1.5 mm²
- Up to 2.000 mt. - cable 2 x 2 mm²
- Up to 2.500 mt. - cable 2 x 2.5 mm²
- Up to 3.000 mt. - cable 2 x 3 mm²

As far as the laying of cables is concerned, follow the below listed instructions:

- Suitable pipes;
- The cables must run at a proper distance from the power lines and must not be in the vicinity of any High Voltage.

Troubles often may be caused by:

- Air-conditioning installation
- Engines or electric welding machines
- Electrical furnaces and elevators
- Radio links, etc.

ELECTRIC POWER

Power Supply Voltage: 220 V single phase +/- 10%.

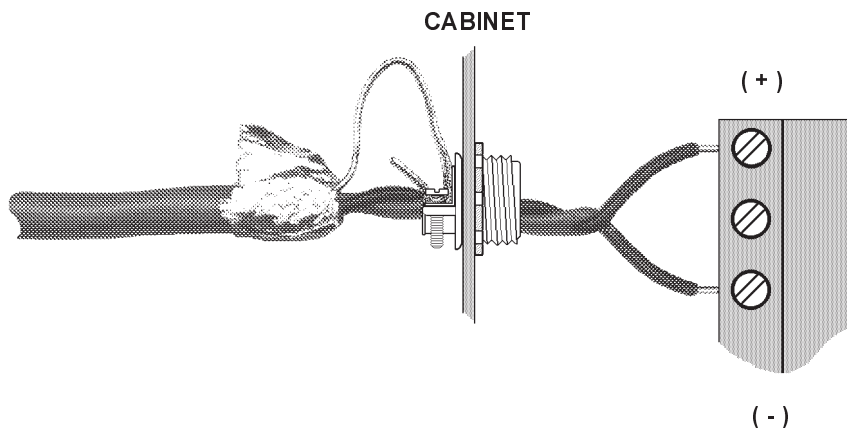
Frequency: 50 Hz +/- 1 Hz.

» **NOTE:** pay special attention when installing the system near big electromagnetic sources (REPEATERS).

EARTH PLANT

The earth plant must be performed according to the CEI and ISPLES rules. The resistance CANNOT exceed 10 Ohm (to be measured at the well with disconnected mains).

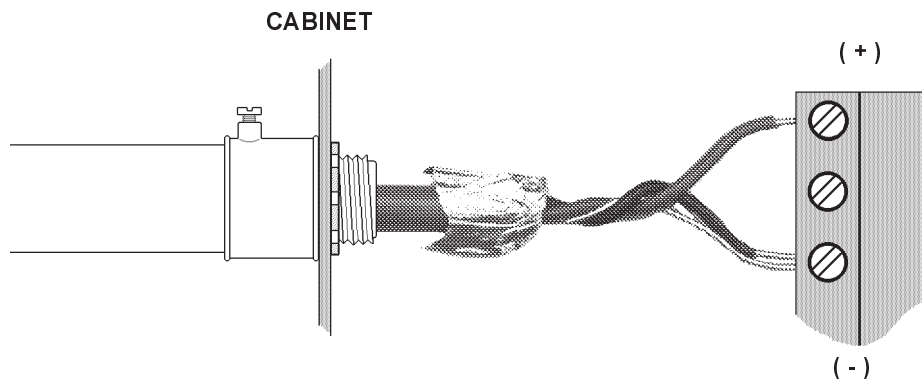
SLC LOOP SHIELD WIRING



FOR SLC LOOP WHICH IS NOT CONTAINED IN PIPING OR METAL PIPING

A) NOTE:

maintain the continuity of the shield wire throughout the loop, BUT DO NOT connect to any devices. Connect the shield wire to the outside of the control panel cabinet and the cabinet to Earth.



FOR SLC LOOP WHICH IS CONTAINED IN METAL PIPING OR IN CONDUIT

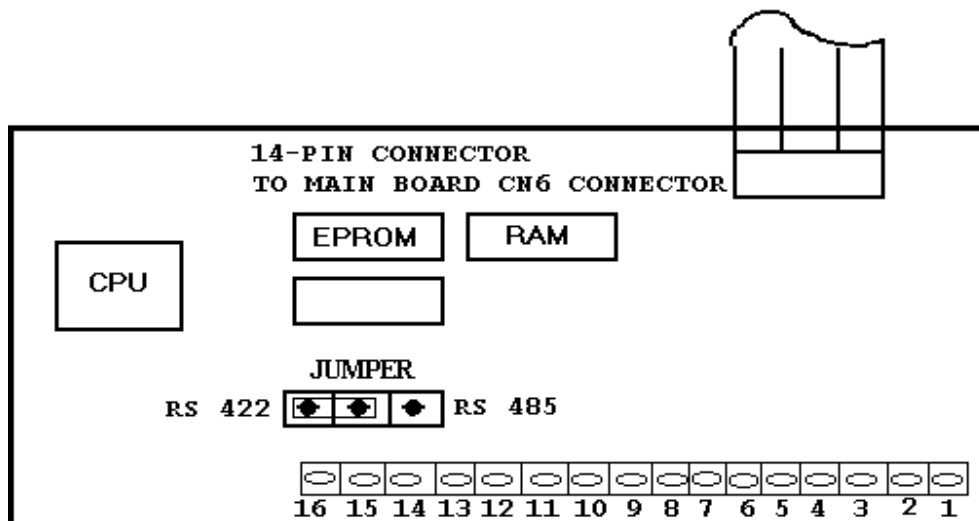
B) NOTE:

in this case, DO NOT allow the shield drain or shield foil to touch the cabinet. For Style 6 field wirings, connect ONLY ONE END of the shield to the negative side of Channel A. Maintain the continuity of the shield wire throughout the loop, BUT DO NOT connect to any devices.

CONNECTOR CN2 on "SIB-600" OPTIONAL BOARD

TERMIN. NR.	DENOMINATION	IT - 485 WIRING	SERIAL PORT CONNECTOR ON PC	
			9 PIN	25 PIN
1	GROUND			
2	RTS	SUPERVISION		
3	CTS			
4	TX			PIN 2
5	RX	PC	PIN 3	PIN 2
6	GND		PIN 5	PIN 7
7	LIN + OUTWARD	WIRING	TERMINAL 4	
8	LIN - RETURN			
9	GND		SHIELD	
10	LIN + RETURN			
11	LIN - OUTWARD		TERMINAL 3	
12	LIN + OUTWARD	ANNUNCIATOR WIRING		
13	LIN - OUTWARD			
14	GND			
15	LIN + RETURN			
16	LIN - RETURN			

» **NOTE :** for wiring of maximum 15 meters use 232 serial line (terminals 4-5-6)
 for wiring exceeding 15 meters use 485 serial line with IT-485 interface (terminals 7-11)



JUMPER ON RS-485 2-WIRE OPEN LINE

JUMPER ON RS-422 4-WIRE (OUTWARD/RETURN) CLOSED LINE (LOOP)

THE 220 VAC POWER SUPPLY LINE

The AM6000 control panel requires connection to a separate 220 VAC 50 Hz line, which must be labeled “FIRE ALARM”.

No other equipment may be powered from the circuit employed for the fire alarm system.

Overcurrent protection for this circuit must comply with local normatives.
Use proper section wire with minimum 600-volt insulation.

TABLE 1 : 220 VAC service line current requirements

The table 1 allows to calculate the total amount of current, in AC amps, that the AC service line must be capable of supplying to the system.

Device Type	Number of Devices	Multiply by	Current in Amps (each)	Total Current/ Type
Main Power Supply	1	x	0,9	0,9
AVPS-6	() max 1	x	0,45	
Total amount of current required for 220 VAC circuit				Amps

MAIN POWER SUPPLY CURRENT DRAW CALCULATION

The Main Power Supply must be capable of powering, all internal system devices (and all external devices) continuously during stand-by condition, which means non-fire alarm condition.

Use table 2 to determine the stand-by load.

Use table 3 to determine the additional current needed during Alarm condition.

The requirements for stand-by and alarm current loads cannot exceed the capabilities of the power supply in either case.

The Main Power supply provides a 24 VDC current up to 3.0 amps so that the system could operate during stand-by or alarm condition.

The current load values into tables 2 and 3 are also valid for the AVPS-6 auxiliary power supply.

Fill in the table 2 for devices that must be steadily powered only.

» **NOTE**

for conventional detectors : in table 2 use the current value indicated for the stand-by condition (refer to manufacturer's instructions for detector current draws).

Write the alarm condition absorptions into table 3.

TABLE 2: stand-by condition current requirements (24 VDC)

Device Type	Number of Devices	Multiply by	Current in Amps (each)	Total Current/ Type
BE-600A (4-line main board)	1	x	0,360	0,360 Ampere
LIB-600 (3 max)	()	x	0,130	
SIB-600 Serial interface board	()	x	0,100	
Detectors/Modules: SDX, CPX e FDX-551 MMX-1, MMX-101, CMX-1, BGX-10L, BG-101L	()	x	0,000210	
ISO-X Isolator Modules	()	x	0,000420	
Control Modules : ACM-16AT, ACM-32A, AEM-16AT, AEM-32A, LCD-80 as Annunciator	() () ()	x x x	0,040 0,002 0,1	
LDM-32	See LDM Manual			
NIB-96	()	x	0,022	
LCD-6000	()	x	0,080	
Other external devices (Solenoids, active relay, etc.)	() ()	x x		
Total amount of current required for 220 VAC circuit				Amps

» **NOTE:** the total of stand-by load obtained in table 2 CANNOT exceed the following values:

- 3.0 Amps for Main Power Supply
- 3.0 Amps for Auxiliary Power Supply (AVPS-6)

ALARM CONDITION CURRENT LOAD

The table 3 allows the system designer to determine the current load that must be supported by the main power supply during an alarm condition.

The total current drawn from the Main Power Supply in alarm condition cannot exceed 3.0 Amps.

Enter the number of devices, for each type, the control panel must power simultaneously during alarm conditions.

» **NOTE**

for conventional detectors : in table 3 use the current value indicated for the alarm condition (refer to manufacturer's instructions for detector current draws).

Table 3 : alarm condition current requirements

Device Type	Number of devices in alarm (simultan.)	Multiply by	Current in Amps (each)	Total Current/ Type
Control Modules: ACM-16AT, ACM-32A, AEM-16AT, AEM-32A, LCD-80 as Annunciator	()	x	0,056	
	()	x	0,056	
	()	x	0,1	
LDM-32	Use the total obtained through the LDM manual			
LCD-6000	()	x	0,100	
Notification Appliances :				
Bells	()	x	()	
Sirens	()	x	()	
Sounders	()	x	()	
Horns	()	x	()	
Strobe Lights	()	x	()	
Other devices powered	()	x	()	
	()	x	()	
	()	x	()	
Total additional current in alarm condition				Amps (B)
Enter the current load in stand-by(see Table 2)				Amps (A)
Total load in Amps in alarm condition				Amps (C)

» **N.B. : If the total load obtained exceeds 3.0 Amps (provided by the power supply), the batteries will supply the current to support alarm conditions.**

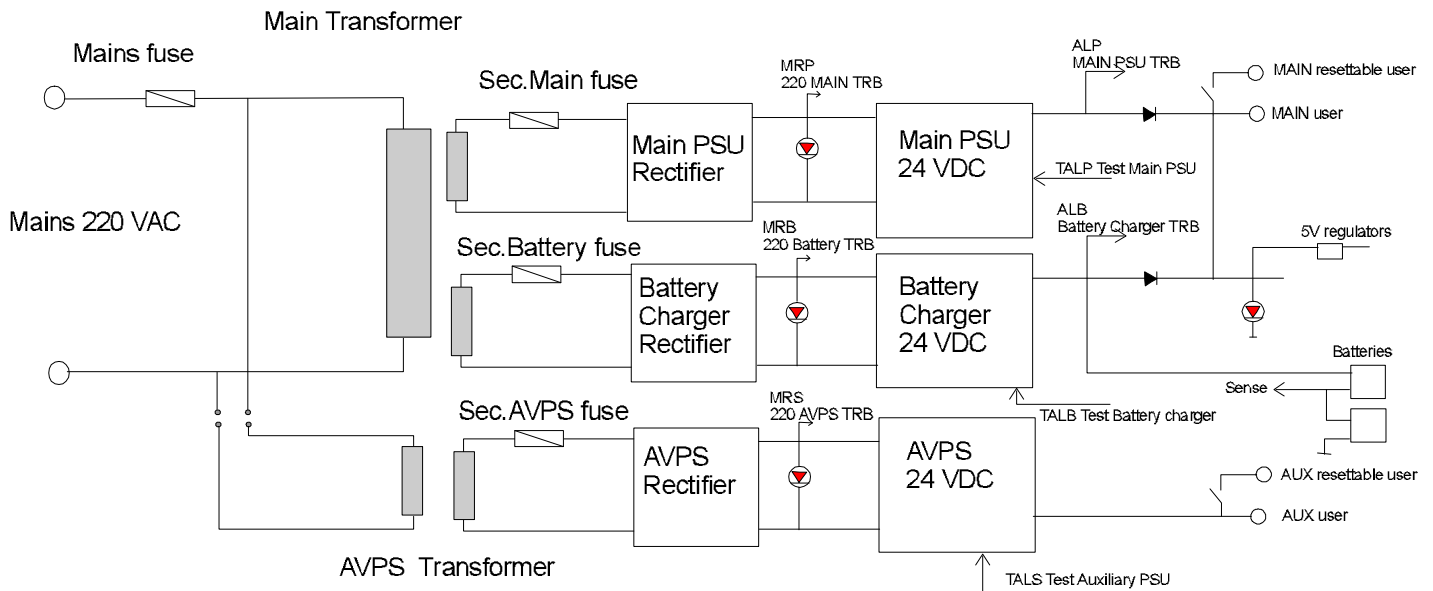
BATTERY CAPACITY CALCULATION

The table 4 allows to determine the size of the batteries needed to support both stand-by condition and five minutes of alarm operation.

Table 4 : battery current load required

Total battery load in Stand-by (see Table 2)	Multiply by	Stand-by time required (24 or 72 hours)	Total current
(A) ()	x	()	
Total battery load in Alarm (see Table 3)		Alarm time required (for 5/60 minutes enter 0.084)	
(B) ()	x	()	
Total current needed			x
Multiply by the derating factor (1.2)			1.2 =
Battery capacity in Amps/hour required			

BLOCK DIAGRAM



Input and Output

- **Mains input**

Input voltage 230 Vac with 5A protection fuse

- **Mains Transformer**

N° 2 39 Vac 3A auxiliaries

The first auxiliary powers the rectification circuit of the main power supply with a 4A protection fuse.

The second auxiliary powers the rectification circuit of the auxiliary power supply with a 4A protection fuse.

The transformer total power is 200 VA

- **+ 24V User Output**

Output voltage 27,6 V 2A . 3A protection fuse.

- **+ 24V Resettable user Output**

Resettable output taken from the +24V User by 5A/ 30 VDC relay contacts.

- **+ 24V Auxiliary Output (on AVPS-600)**

Output voltage 27,6 V 3A . 3A protection fuse

- **+ 24V Resettable Auxiliary Output (on AVPS-600)**

Resettable auxiliary output taken from the +24 V auxiliary by 5A/ 30 VDC relay contacts.

Visual indications on the P.S.U. board

- Green LED = "Panel powered (mains 220 VAC or Batteries)" - indication
- Yellow LED = "Battery low" - trouble
- Green LED = "Battery charger ok" - indication
- Yellow LED = "Positive scatter on earth" - trouble
- Yellow LED = "Negative scatter on earth" - trouble
- Green LED = "Main P.S.U. ok" - indication
- Green LED = "A.V.P.S. ok" - indication

Troubles Indication List

- **Power supply trouble.**

Any power supply trouble generate a system trouble and a general trouble signal; the general trouble relay is de-activated and the buzzer sound.

- **Mains trouble.**

It annunciates that the mains voltage is less than 50 Vac.

In case of trouble for mains loss, the following items are activated: system trouble led, general trouble led, buzzer and the mains loss trouble message is shown on the LCD display.

- **Insufficient tension on the main power supply.**

The mains voltage is verified to be less than 170 Vac.

If a mains trouble has been signalled (voltage ≤ 50 VDC), this trouble signal will not be displayed.

- **Insufficient tension on the auxiliary power supply.**

It indicates that the mains voltage is less than 170 Vac.

If there has been a mains trouble (voltage ≤ 50 VDC), this trouble signal will not be displayed.

- **Insufficient tension on the battery charger.**

It indicates that the mains voltage is less than 170 Vac.

If there has been a mains trouble (voltage ≤ 50 VDC), this trouble signal will not be displayed.

- **Overvoltage on the main power supply.**

It indicates that the mains voltage is more than 263 Vac.

- **Overvoltage on the auxiliary power supply.**

It indicates that the mains voltage is more than 263 Vac.

- **Overvoltage on the battery charger .**

It indicates that the mains voltage is more than 263 Vac.

- **Main power supply failure or overload.**

It indicates that the main power supply output voltage is less than 21 Vdc.

- **Auxiliary power supply failure or overload.**

It indicates that the auxiliary power supply output voltage is less than 21 Vdc.

- **Main power supply user fuse.**

This trouble signal indicates the following condition:

output user voltage < 17 Vdc

- **Disconnected auxiliary power supply signal.**

Each trouble on the auxiliary power supply is signalled only if its connection has been setted in the system programming.

The connection of the auxiliary power supply board is verified by a < 4 Vdc voltage signal.

- **Auxiliary power supply user fuse trouble.**

This trouble signal indicates the following condition:

output user voltage < 17 Vdc

- **Siren output fuse trouble.**

This trouble signal indicates the following condition:

Output siren voltage < 17 Vdc

- **Scatter on earth trouble.**

This trouble signal indicates that there is a scatter on earth (positive or negative) with an integration of 30 sec..

There is a jumper to enable or disable this signal.

Battery Charger Section

- **Battery charger failure or overload.**

It indicates that the battery charger output voltage is less than 21 Vdc

- **Disconnected battery or battery fuse trouble.**

A periodical test is executed only if the 220 mains is connected (voltage ≥ 170 VAC) and the main voltage $\geq 24,5$ VDC. The test goes on for 5 seconds.

This trouble signal indicates the following conditions:

battery voltage ≤ 21 Vdc

battery fuse disconnected

If the battery is connected, the following test (Faulty battery) follows:

- **FAULTY BATTERY Test.**

It is executed every minut.

The "Battery Charger Test" signal is activated for 10 seconds; as a consequence of that, the battery charger output voltage is lower.

The battery charger output voltage is verified to be $\geq 24,5$ VDC with connected batteries.

- **Exhausted battery trouble.**

This test is executed only in 220 VAC. mains trouble conditions (≤ 170 VAC)

The battery voltage is verified to be ≤ 23 Vdc.

- **Battery Release.**

When the mains voltage is insufficient (≤ 170 Vac) and the battery voltage is ≤ 20 Vdc, the battery release relay is activated to avoid a damage on batteries and possible incorrect functionalities on the control panel, causing the control panel switching off.

- **Unbalanced battery recharger trouble.**

The separate batteries voltage are verified to be at most half the recharger output voltage $\pm 1,3$ V.

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