RONAN ENGINEERING COMPANY

Installation Operation Manual

Series X11CB Event Recording Annunciator

Ronan Engineering Corporation
28209 Avenue Stanford
Valencia, California 91355

www.ronan.com
(661)702-1344
(800)327-6626

X11CB-3031-IOM
Rev 0.1

Revision	0.1	
Document Number	X11CB-3031-IOM	
*Originator / Editor	Jim Bates	Jun 10, 2014
*Approved by	Mike Corwin	Jun 10, 2014
*Quality Assurance	Tony Gasca	Jun 10, 2014

.* - initial for document control

REVISION LOG

Rev#	Description	Date	Originator	Approval	Quality Assurance
0.0	Series X11CB Event Recording Annunciator Operators Manual	4/4/2013	JLB	MC	WW
0.1	ECO 16250 - Consistent branding with company marketing standards	06/10/14	JLB	MC	TG

Table of Contents

List of Figures

Illustration Index

Index of Tables

1. Overview

The Ronan Series X11CB Computer Annunciator system is a state of the art annunciator system with event recording capabilities. The X11CB system supports a variety of communications protocols used in process automation systems. It is designed to provide the most advanced data acquisition and monitoring system that meets or exceeds the requirements of the process and power industries in the most economical way.

The system is comprised of a group of alarm modules within one or more interconnected chassis. A single alarm module monitors its respective field contact input(s) and provides visual and audible status of those inputs. The quantity of alarm modules and chassis within the X11CB system is defined by the requirements of that system. The system also contains an integral interface module that provides Ethernet communication interface to the external host computer, local network or plant network. Common Trouble Alarm (CTA) and Horns 1 and 2 are generated by participating local field contacts and remote field contacts sources and configured by the operator. Optional programmable auxiliary relay outputs are available for each individual field contact.

The followings are some of the X11CB Annunciators key features:

- The system is offered in both the X11CB Window Annunciator model and the X16CB Remote model with no alarm window display.
- Both the X11CB and X16CB are available in a panel mount, rack mount or surface mount style Chassis. General purpose, NEMA4, NEMA12 and NEMA4X chassis are available for all chassis types.
- The Window Annunciator model features Monalarm, Binalarm, Trialarm and Quadalarm within Ronan's standard 3.5 inch (89mm) by 3.5-inch (89mm) mechanical cabinet modules.
- Optional redundancy processor for Monalarm and Binalarm windows systems.
- A redundant Monalarm or Binalarm system can be created by adding a daughterboard alarm module to an existing alarm module.
- The Remote field contact multiplexers (X16CB or X501MUX) can be used to provide remote field contact input monitoring via an Ethernet interface. Individual light indicators at the multiplexers provide normal or abnormal status output for each field contact.
- Each single plug-in module is internally expandable from one to four input channels to create Monalarm, Binalarm, Trialarm and Quadalarm display units.
- Both interface module and alarm module utilize the ARM Cortex M3 Microcontroller. This is a state of the art high speed compact ARM embedded processor.
- Each alarm module contains up to four optically isolated input alarm circuits of high-speed conventional CMOS integrated circuit design with maximum noise immunity and reliability.

- Field contact inputs can be configured as dry or live inputs with a variety of voltages available.
- The polarity of each field contact is field selectable as normally open or closed using a jumper selector for each channel.
- The most popular industry-wide sequences of ISA, such as A, M, F1A, F2A, F3A, FM, F2M and F3M are available. For Ringback sequences there are R-1, R-12, and RFAH.
- The system is powered by an external regulated 24VDC power supply. Input power to supply is 90-260 AC or 120-370 VDC input.
- IRIG-B input provided for accurate time reference for event time stamping. All events are recorded to +/- 1mS.
- In the event of a lost or failing IRIG-B input the system will time stamp events with an internal timing system.
- User friendly applications such as system configuration, data base server, event viewer and report generator are utilized to configure and monitor the system.
- Software configurable filters provide noise rejection and switch de-bounce functions for each field contact input.
- Hot swappable Alarm Modules allow removal and installation of any alarm module without effecting the normal operation of the system.
- Alarm module addressing resides within the alarm chassis allowing the interface module to interrogate each alarm module for correct configuration on a periodic basis. Modules found to be configured improperly will be re-configured to the current locations configuration. Failing alarm modules can be replaced with spare modules without removing power and will be re-configured to the locations configuration.
- A maximum of 100 modules are allowed per single IM CAN bus monitoring up to 4 channels each for a total of 400 channels of monitoring.
- Ethernet interface
- Comprehensive user configuration with standard windows software

Note:

Do not rely on any part numbers in this manual for the purpose of ordering or re-ordering parts for an X11CB unit. As the product matures and parts are updated, the part numbers may change.

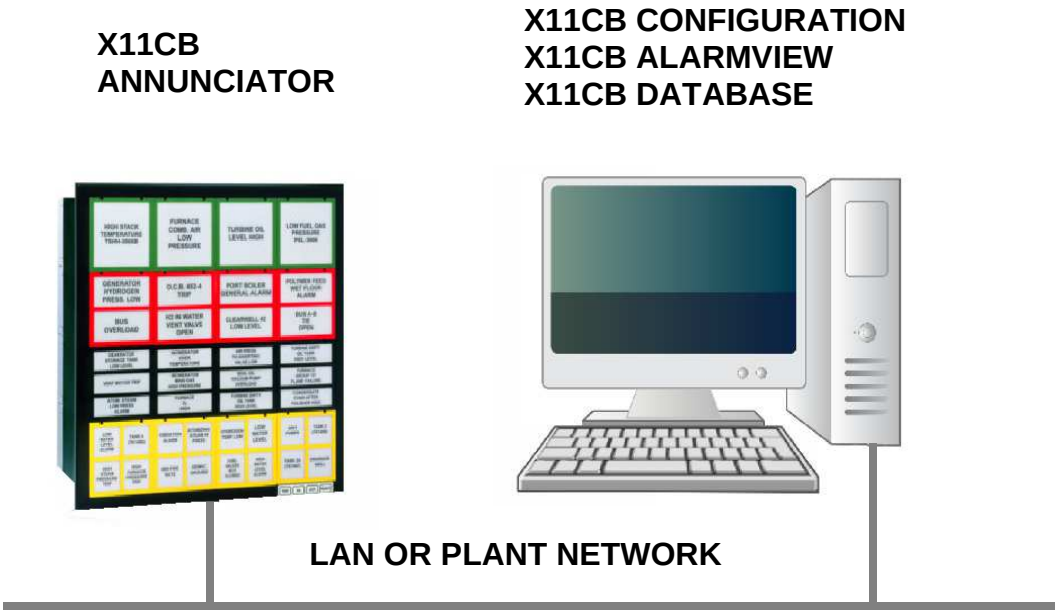


Illustration 1: X11CB Basic LAN System

1.1. Glossary of Terms and Abbreviations

AM	Alarm Module
AUX	Auxiliary Relay
CTA/CA	Common Trouble Alarm/Common Alarm
DWG NO	Drawing Number
FC	Field Contact
GF	Global Function / General Function
H1	Horn 1
H2	Horn 2
IM	Interface Module
IP	Internet Protocol
MEIN	First Out / Multiple Engaged First In
NC	Not Connected / Normally Closed
NO	Normally Open
TCP	Transport Control Protocol.
TO	Transistor Output
REC-UCM	Ronan Engineering Co. Universal Communication Module

Relay Definitions

Form A	contacts are also called N.O. (Normally Open) contacts or make contacts.
Form B	contacts are also called N.C. (Normally Closed) contacts or break contacts.
Form C	contacts are also called changeover contacts or transfer contacts. Also called double-throw typically (SPDT or DPDT, etc.)

1.2. SAFETY

The following safety symbols are used on the SERIES X11CB

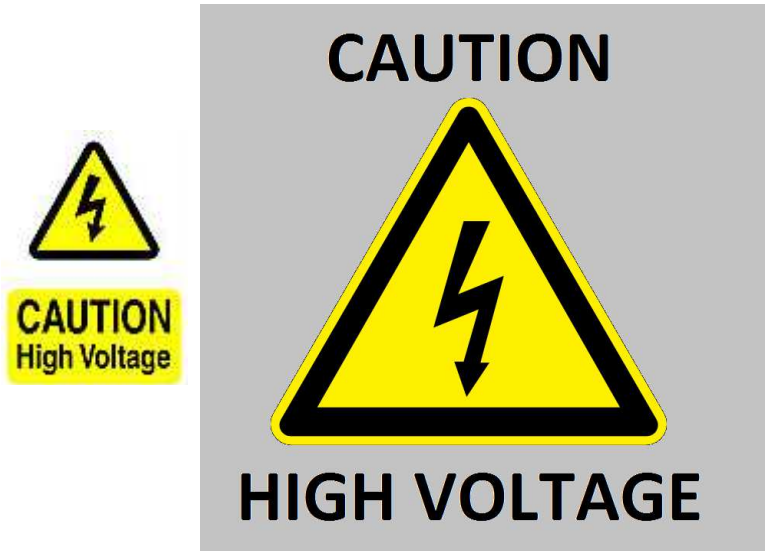


Illustration 2: Caution Labels

Any symbol similar to the ones illustrated above will be found on equipment where the voltage exceeds 48VAC or 48VDC. These symbols may or may not be in the colors illustrated, and could be printed in Black and White only.

1.3. References

QA400	: Design Control
QA4000	: Design Development Quality Assurance Plan
QA4500	: Project Archive
X11CB-3001-IOM	: X11CB Configuration Software User's Manual

1.4. Specifications and Power Requirements

1.4.1. System Voltage

- LED lamp, Logic: 24 VDC ± 20%
- Field contacts: 24 VDC, 48 VDC, 125 VDC, or 115 VAC.

1.4.2. Power Source (System External)

- System Power Supply: 90-260 VAC 50/60 Hz; 120-370VDC
- Converter: 24 VDC

To specify the correct power supply, count the number of alarm modules you need to power from the supply. Calculate the total requirements as follows:

Total Watts = Number of Modules x Wattage for each Module or Card

Model	Power (Watts)
X11CB (Interface Module)	5.0 W
X11CB (Alarm Module)	7.0 W
X11CB (Aux Relay Card)	4.0 W

Table 1: Power Requirements

1.4.3. Temperature / Humidity Range

- Operating: 0° to 60° C (32° to 140° F)
- Storage: -40° to +80° C (-40° to + 176° F)
- Operating Humidity: 5% to 95% RH non-condensing.
- Storage Humidity: 5% to 95% RH non-condensing.

1.4.4. Field Contact Inputs

- Contact: Dry or Live
- Field Selectable: Normally Open / Normally Closed
- Interrogation Voltage: 24 VDC, 48 VDC, 125 VDC, or 115 VAC
- Digital time delay filters

1.4.5. Response Time

- 20 Milliseconds by default. It can be modified using the X11CB Configuration software.

1.4.6. EMI/RFI Compatibility

- CE Compliant

1.4.7. Relay Contacts

- All relay contacts are typically Form C, 1 Amp @ 28 VDC; 0.65 Amp @ 115 VAC

1.4.8. Open Collector Transistor Output

- Open Collector Transistor Output 200 mA @ 28 VDC

1.4.9. Outputs

- Visual: Fast Flash, Medium Flash, Slow Flash, Steady on, Intermittent Fast Flash
- Audible: Dual, Selectable by Cabinet Module
- Auxiliary Relays: Normally not Energized
- Common System Trouble
  Open Collector Transistor
  (relay available with optional remote I/O terminal assembly)
- Common System Reflash
  Open Collector Transistor
  (relay available with with optional remote I/O terminal assembly) –

1.4.10. Controls / Switches

- Momentary Push Button: Local or Remote; Single Pole
- Normally Open; +24VDC Switched;
  Silence, Acknowledge, Reset, Test, First-Out Reset, GP1 and GP2

1.4.11. Diagnostic

- System Trouble Alarm (RUN)
  Open Collector Transistor
  (relay available with optional remote I/O terminal assembly)
- Red System trouble Alarm and Green Power present LED indicators with optional front panel switch assembly.
- Ethernet Status LEDs (Green-Link and Amber-Activity)

1.4.12. Event Logging

- Ethernet: RJ45 to External Host (Ronan database server application)

1.4.13. Network Protocols

- TCP/IP
- UDP Ronan Proprietary
- MODBUS RTU
- DNP3 (with optional REC-UCM)

1.4.14. Ethernet Interface

- Ethernet port supports 10Mbps and 100Mbps
- Interface to Ronan supplied Software Applications
- Software: Ronan X11CB_Configuration
  X11CB_ALARMVIEW
  X11CB_DATABASE

1.4.15. Special Features

- Alarm Capacity: 100 Alarm modules with up to four alarm points each on a single Interface Module
- Redundant Interface / Alarm Module operation with 1 or 2 windows
- Event recording capability with local IM storage during lost communication path
- Remote monitoring through Ethernet interface
- Supports a variety of industry protocols (Modbus RTU, DNP3)
- Hot swappable Interface and Alarm Modules
- Industrial internal communication protocol (CAN)

1.4.16. System Size

- Basic Cabinet Module: 3.50 inch (88.90 mm) x 3.50 inch (88.90 mm)
- Modular design can accommodate virtually any application
- Compact design Reduces chassis depth to ~8.00 inches (204.70mm)

1.4.17. System Weight

- Per Cabinet Module: 1.75 pounds (0.79 kg), Not Including Power Supply and Power Filter Modules

1.4.18. Warranty

- One Year

1.4.19. Approvals In Process

- UL: Underwriters Laboratories
- CUL: Canadian Underwriters Laboratories
- CE: Cenelec

1.4.20. Installed Environment

- Indoors: Annunciator display Chassis and associated parts are manufactured NEMA 1 enclosures (general purpose), do not expose a NEMA 1 chassis to dripping water or other liquids. Equipment may be wiped clean with a mild cleaner.

- Indoors/Outdoors: Annunciator Equipment and associated parts must be installed in an IP65 type enclosure. Annunciator equipment and related parts must be installed in an enclosure that provides protection against splashing water, rain, sleet, snow and hose directed water (NEMA 4). This option is available at time of purchase from the factory.

- Indoors/Outdoors Corrosion Proof: Annunciator Equipment and associated parts must be installed in an IP65 type enclosure. Annunciator equipment and related parts must be installed in an enclosure that provides protection against splashing water, rain, sleet, snow, hose directed water and provide additional protection against corrosion (NEMA 4X). This option is available at time of purchase from the factory.

2. X11CB Hardware

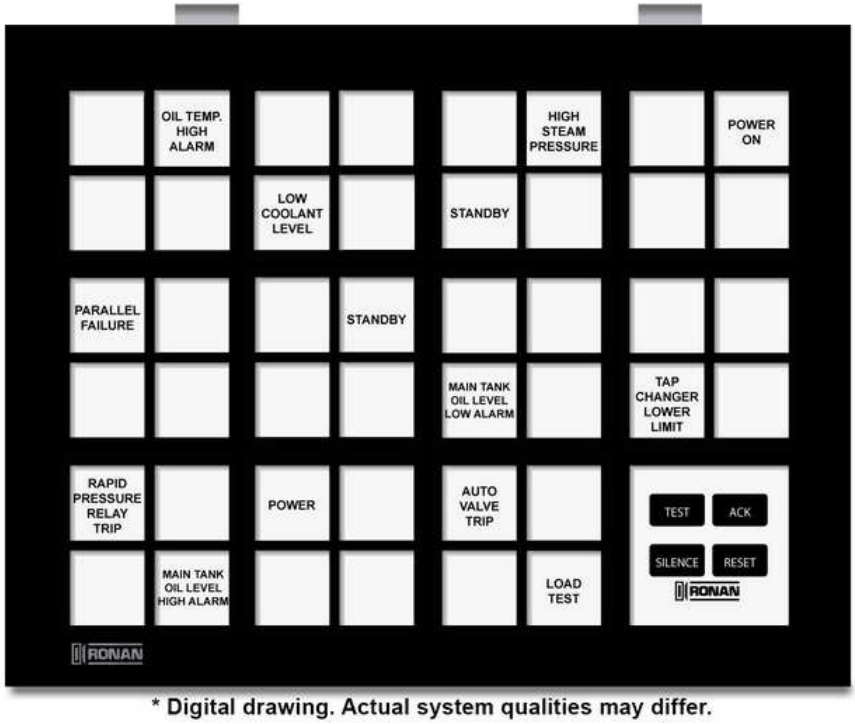
The Ronan X11CB Computer Annunciator System with microprocessor based electronics is assembled from basic 3.50 inch (88.90 mm) by 3.50 inch (88.90 mm) modules to make up the overall size requirements and number of windows required.

The mechanical modules assembled from aluminum castings and extrusions provide excellent heat dissipation for a continuously lit annunciator system and feature the structural strength required in industrial applications.

The rear terminal is designed as a single piece molded plastic assembly per window for durability. Module array last module (bottom right) contains the Interface Module to connect system to an external host.

CONSTRUCTION

System Front View

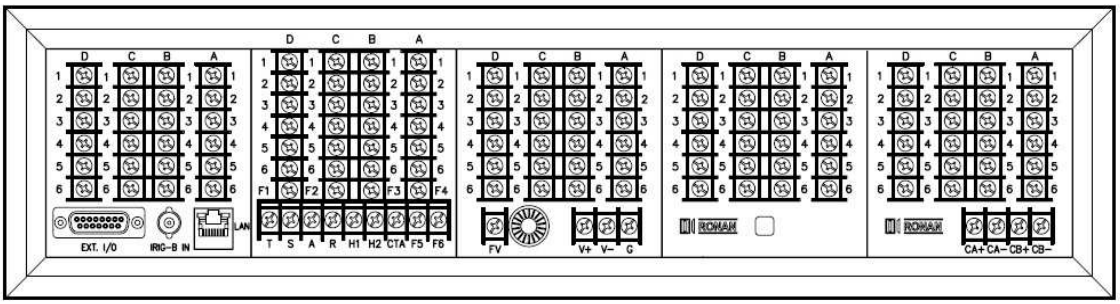


* Digital drawing. Actual system qualities may differ.

Illustration 3: X11CB system front view

Notice the optional membrane button pad in the lower right hand corner.

System Rear View



Membrane buttons with LEDs can be mounted on the frame either horizontally or vertically.

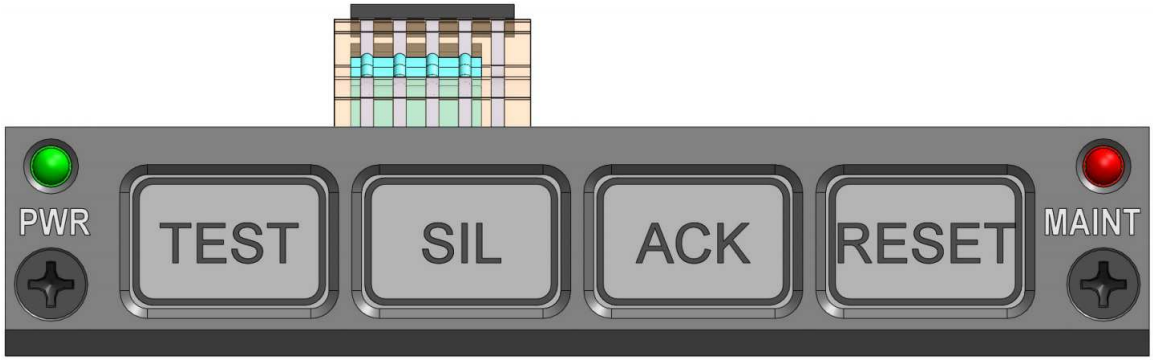


Illustration 4: Membrane Switches with LEDs

Membrane buttons only, can be mounted on the frame either horizontally or vertically.

Illustration 5: Membrane Switches without LEDs

2.1. Module Configurations

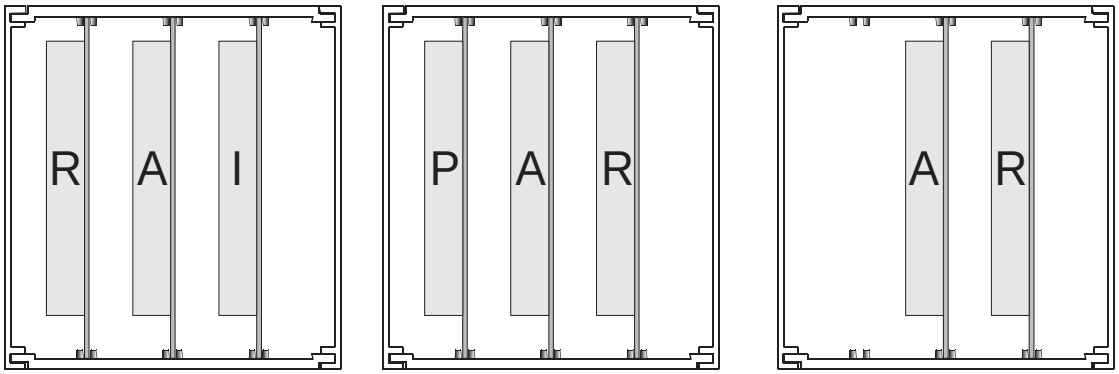


Illustration 6: Board positions within the chassis

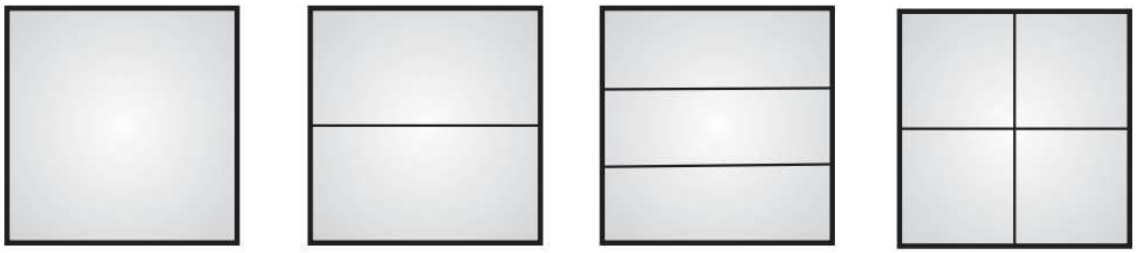
Legend:

P: Power Filter Card
A: Alarm Card
I: Interface Module
R: Relay Card

There are currently 5 different types of chassis. The above illustration shows the Interface Module chassis on the left, the Power Supply chassis in the middle, and the remaining chassis on the right.

2.2. Annunciator Windows

The Annunciator windows come in four sizes as shown below. Legends can be engraved or laser printed on transparency film and inserted into the window frame. Colored LEDs are used to illuminate in color.



1000 Series **2000 Series** **3000 Series** **4000 Series**

2.3. HARDWARE CONFIGURATION

2.3.1. Field Contact Type and Voltage (FCV)

Field contacts can be set as normally open or normally closed by setting jumper connections on each alarm module. (Described in the Alarm Module section of this manual)

- Dry contact: The system internal interrogation powered 24 VDC.
- Live contact: Opto-isolated inputs. The opto-couplers provide 2,500- volt isolation.
- 24 VDC, 48 VDC, 125 VDC or 115 VAC, 240 VAC

2.3.2. Alarm Module Address

The alarm module address is described in the appendix of this manual. The address is actually the CAN bus address and can be within the range of 1 through 254 inclusive.

2.3.3. Alarm Module Configuration

The Alarm and Interface Modules are software configured by the Ronan X11CB_Config application. Each X11CB application is described in its own manual.

2.4. X11CB Annunciator Display Modules (Alarm Module)

The X11CB alarm module utilizes an ARM Cortex M3 Microcontroller for the monitoring of each field contact input to the module. This is a high speed compact ARM embedded processor. The following are its main features:

2.4.1. Microcontroller (U1)

1. 32-bit RISC performance using ARM® Cortex™-M3 architecture
2. 25-MHz operation
3. 256-KB single-cycle flash
4. 64-KB single-cycle SRAM
5. Controller area network (CAN) module

After the Ethernet connection is made between the host computer and the X11CB-IM (X11-2048), the X11CB configuration software can reprogram the contents of the Flash Memory that contains the configuration. (For reprogramming the Microcontroller see X11CB Software Manual).

The X11CB Alarm module allows field programmable selections of all commonly used ISA sequences as well as custom sequences from a host computer.

The lamp display of each module can have single, dual, triple or quad alarm window alarm logic displays for each channel and field contact polarity of each channel is selected by setting the jumpers on the board.

2.4.2. Display and Name Plates

The colored LEDs can be supplied in a variety or colors to distinguish such functions as fire alarm or shutdown, etc.

The nameplates are an option to the Visual Annunciator, and are generally supplied with white front lenses. This lens displays all windows white in non-lit status, changing to the selected color in on condition.

Each window consists of four LED lamps, altogether with 16 LEDs per lamp module. (exception being the 3000 series which contains only 12 LEDs)

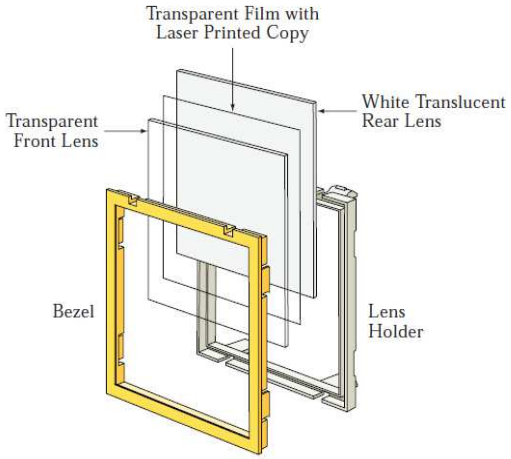


Illustration 7: Sandwich Nameplates

2.4.3. Color Coded Bezels

The bezels are available in eight colors (black, brown, red, yellow, green, blue, gray and white) to allow distinction of the different system functions, such as sequence types, first out groups, common alarm groups, etc.

NOTE:
All lens holders are white .

The following is the color specification for each X11CB type.

0 - Black	5 - Green
1 - Brown	6 - Blue
2 - Red	7 - Grey
4 - Yellow	8 - White

Table 2: Bezel Colors

2.4.4. Lens / LED Colors

Red	White
Yellow	Blue
Green	Amber

Table 3: Standard LED Colors

2.4.5. Monalarm Module:

Part NO: X11CB-1000

The Monalarm plug-in Module features single channel alarm logic with sixteen LED type indicators illuminating a 3.50 inch (88.90 mm) x 3.50 inch (88.90 mm) wide window.

Illustration 8: Monalarm Plug-In Module

2.4.6. Binalarm Module:

Part NO: X11CB-2000

The double window Binalarm Module contains two channel alarm logic with each channel eight LED type indicators illuminating a 1.75 inch (44.45 mm) x 3.50 inch (88.90 mm) wide window.

Illustration 9: Binalarm Plug-In Module

2.4.7. Trialarm Module:

Part NO: X11CB-3000

The three window Trialarm Module provides three 1.66 inch (29.63 mm) high by 3.50 inch (88.90 mm) wide nameplates and is illuminated by three sets of each channel four LED type indicators. Each set is driven by one channel of the three-channel alarm logic.

Illustration 10: Trialarm Plug-In Module

2.4.8. Quadalarm Module:

Part NO: X11CB-4000

The four windows Quadalarm Module represent the highest density of annunciation in the X11CB series. The 1.75 inch (44.45 mm) high by 1.75 inch (44.45 mm) wide window is illuminated by four LED indicators.

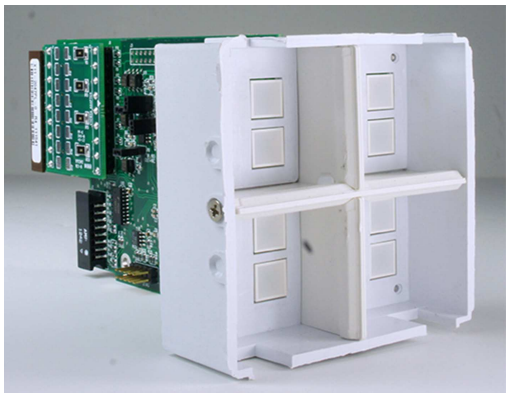


Illustration 11: Quadalarm Plug-In Module

2.4.9. Redundant Monalarm Module:

Part NO: X11CB-1000R

The Redundant Monalarm plug-in Module features monitoring of a single field contact input with two independent channels of alarm logic. Each channel drives eight LED type indicators for a total of 16 indicators illuminating a 3.50 inch (88.90 mm) x 3.50 inch (88.90 mm) wide window.

Illustration 12: Redundant Monalarm Plug-In Module

2.4.10. Redundant Binalarm Module:

Part NO: X11CB-2000R

The Redundant Binalarm plug-in Module features monitoring of a two field contact inputs each with two independent channels of alarm logic. Each channel drives four LED type indicators for a total of 8 indicators illuminating a 1.75 inch (44.45 mm) x 3.50 inch (88.90 mm) wide window.

Illustration 13: Redundant Binalarm Plug-In Module

2.4.11. Alarm Module Jumper Locations

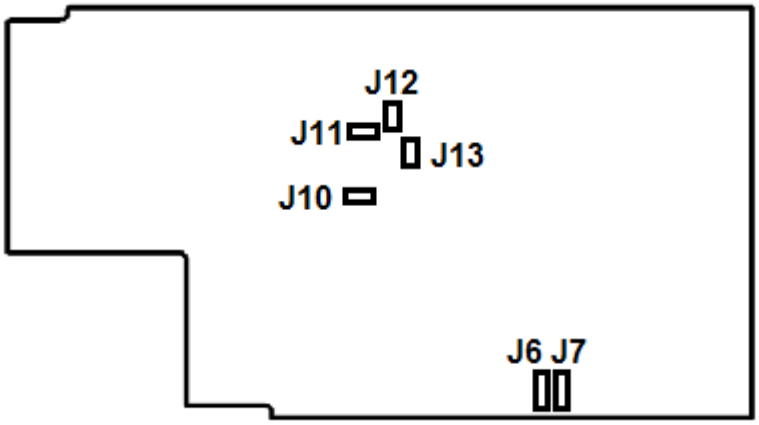


Illustration 14: X11CB-Alarm Module Jumpers

Jumpers **J10** thru **J13** Normally Open / Normally Closed Selection:

J10 – Field Contact **A** Selection
J11 – Field Contact **B** Selection
J12 – Field Contact **C** Selection
J13 – Field Contact **D** Selection

IN = Normally Open, **OUT** = Normally Closed

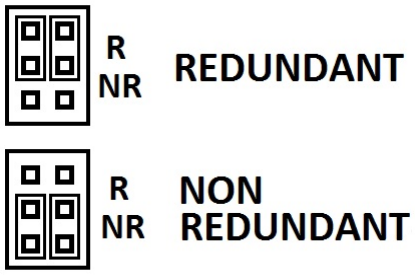


Illustration 15: J6 and J7 Redundant / Non Redundant Jumpers

2.4.12. Power Sources

The external 24 VDC power is bussed internal to the chassis and is provided to the Alarm Module at J2 pin 7 on the PC board. A surface mount fuse F6 is provided to protect for over current failures within the Alarm Module.

The fused output of F6 provides 24VDC to voltage regulators U9 and U6. They regulate the 24VDC down to 5 VDC and 3.3VDC respectively.

There will be Power Distribution Points throughout the system that can handle a maximum of 240 Watts. Every Power Distribution chassis will have a Power filter card installed in the left side of the chassis as viewed from the front.

Illustration 16: X11-2039PL Power Filter

2.4.13. Field Contact Inputs

The field contact inputs can be connected in several different ways (dry, live and Open collector) and can accommodate a variety of voltages. This is accomplished with the use of a voltage adapter card (X11C842-X) installed on the alarm module.

Field Voltage
125VDC - LIVE
24VDC - DRY
48VDC - LIVE
115VAC/125VDC OPTO-ISOLATED
240VAC/250VDC OPTO-ISOLATED
250VDC - LIVE
24VAC/24VDC OPTO-ISOLATED
24VDC Open Collector
48VAC/48VDC OPTO-ISOLATED

Table 4: Field contact Voltage and connection type selection table

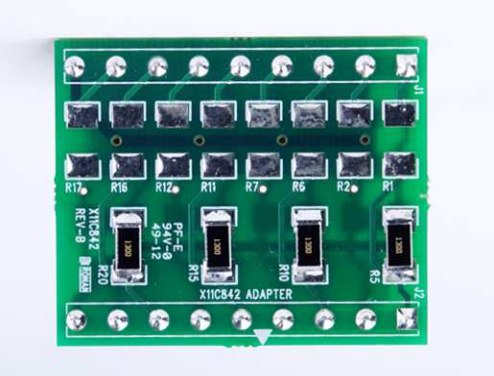


Illustration 17: Field Contact Power Selection Adapter Board

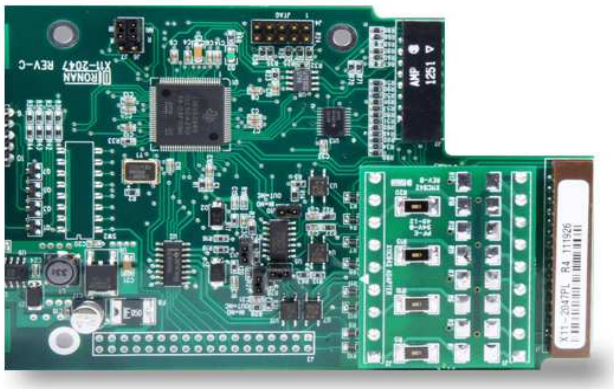


Illustration 18: Power Selection Adapter Mounted on Alarm Module

2.4.14. Field Contact Wiring Diagrams

The following describes each field contact arraignment. For wiring diagrams refer to section 2.7 Wiring Instructions of this manual

- Dry contact: The field contact connection type provides an internal interrogation voltage of 24 VDC. This is a non isolated field contact connection where no external field contact voltage is required.

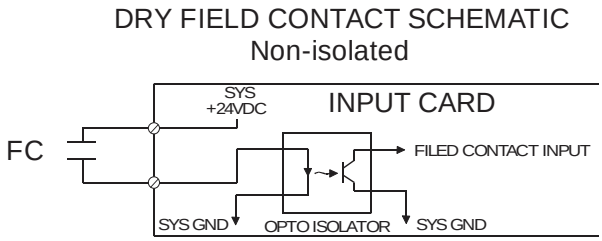


Illustration 19: Dry Field Contact Schematic

- Live contact with isolation: This field contact connection type requires an external power source for the field contacts. To provide isolation the connections are only made at the field contact terminals.

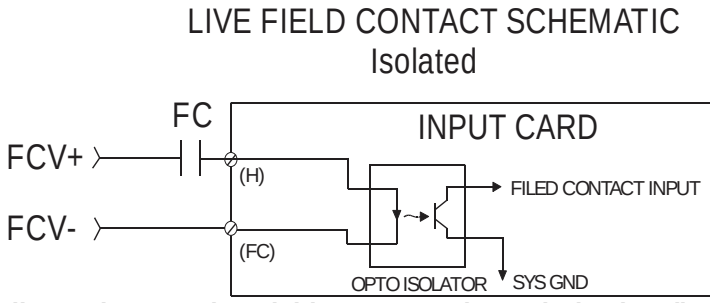


Illustration 20: Live Field Contact Schematic (Isolated)

- Live contact without isolation: This field contact connection type requires an external power source for the field contacts and provides no isolation. The Field contact negative voltage (ground) is connected to the systems negative voltage terminal (V- or ground) for all field contact returns.

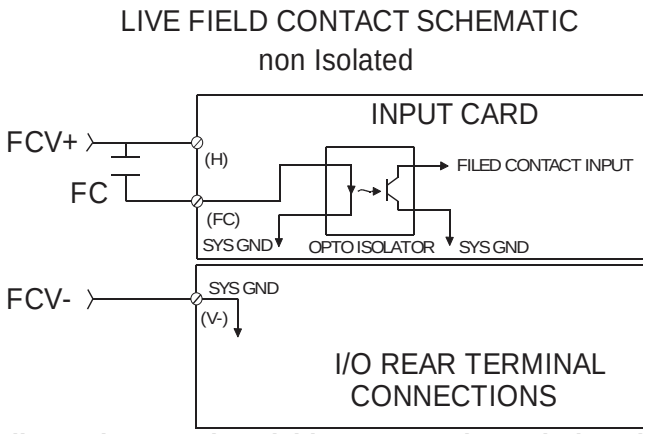
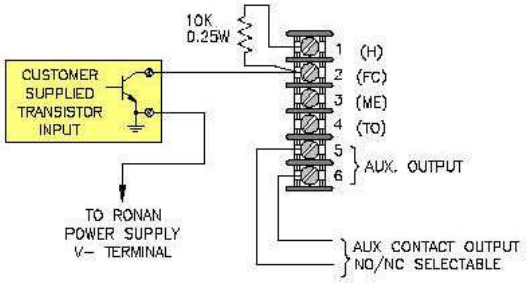


Illustration 21: Live Field Contact Schematic (non isolated)

- Open Collector field contact connection:



When the field contact inputs are configured as isolated inputs, opto-couplers U3, U4, U7 and U11, provide 2,500 volt isolation. See Figures above for isolated / non-isolated field contact connections.

The following external voltages are acceptable live field contact voltages:

24 VDC, 48 VDC, 125 VDC, 250 VDC, 24VAC, 48VAC, 115 VAC and 240VAC

All acceptable external field contact voltages are required to be within ±10% of the defined voltage.

All field contacts can be set to operate as normally open or normally closed by setting jumper switches (J10 for field contact A, J11 for field contact B, J12 for field contact C and J13 for field contact D). With the jumper installed normally open is selected. With the jumper not installed normally closed is selected module.

2.5. Outputs

2.5.1. Auxiliary Output Signals

These signals provide open collector outputs to energize the relays on an optional auxiliary relay module. These outputs are programmable and can indicate a variety of system status or functions (follow field contact input, alarm condition, alarm to Acknowledge). These relays are OMRON G5-2 hermetically sealed

Contact Ratings

Load	Resistive load
Contact type	Bifurcated crossbar
Contact material	Ag + Au-clad
Rated load	0.5 A at 125 VAC; 2 A at 30 VDC
Rated carry current	2A
Max. switching voltage	125 VAC, 125 VDC
Max. switching current	2A

Table 5: Auxilliary Output Contact Ratings

4 types of Auxiliary relay modules are available:

Type	Description
single relay	for one channel alarm modules
two relay	for two channel alarm modules, or one channel dual AUX
three relay	for three channel alarm modules
four relay	for four channel alarm modules, or two channel dual AUX

Table 6: Auxilliary Relay Options

WARNING:
Before setting up the X11CB system, make sure that power to the system is completely off.

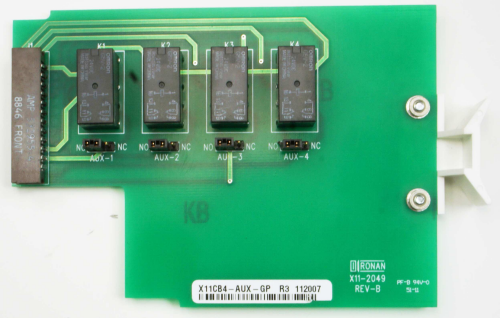


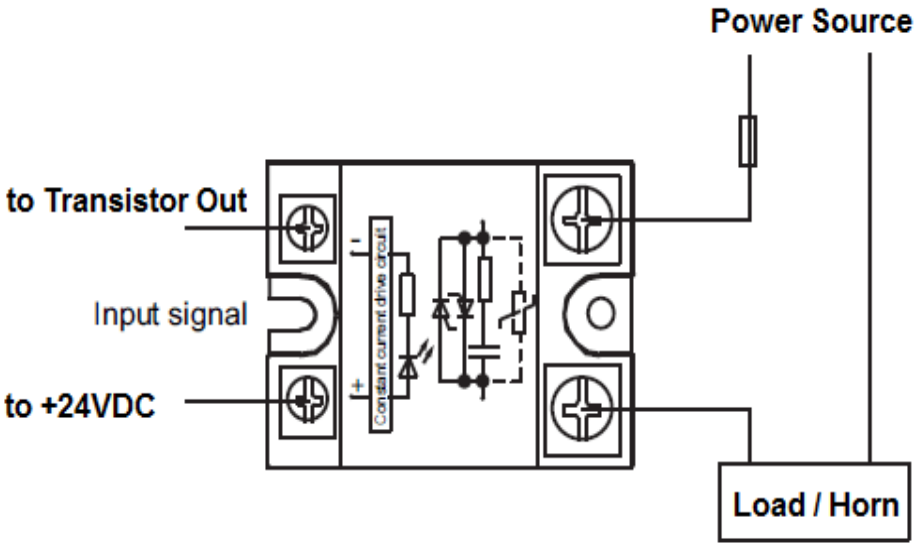
Illustration 22: X11-2049 Relay Board

Notice that the jumper settings are clearly identified as NO normally open (left 2 pins) and NC normally closed (right two pins) on each of the 4 AUX relay 3 pin jumpers.

2.5.2. Transistor Outputs

A single transistor output terminal is provided for each of the four alarm channels at the rear terminal assembly of the alarm module. These outputs are programmable and can indicate a variety of system status or functions (follow field contact input, alarm condition, alarm to Acknowledge and follow lamp output). These outputs are configured as Open Collector Transistor outputs where the emitter is connected to the system ground and collector is connected to the output pin. In an active output state the transistor is turned on and will connect the terminal to the system ground through the transistor. This provides a Active current path that activates a device (horn or relay) connected to this terminal. In an inactive state the transistor is turned off and does not connect the output to the system ground. This removes the current path to ground and turns off the connected device. These outputs are capable of sinking the following current at the following voltage:

- Open Collector Transistor Output 200 mA @ 28 VDC



2.5.3. LED Lamp Output

An X11CB system can accommodate up to six different types of lamp output arrangements (1000, 2000. 3000, 4000, R1000 and R2000). Each individual alarm lamp output can be configured as one of the following LED colors (Red, Green, Blue, White, Yellow and Amber). There are four LED driver transistors (Q1, Q3, Q5, Q7), located on the alarm module. Each one of these transistors drives one of four different lamp sections within the lamp assembly. Each lamp section contains four LED cubes containing 2 LEDs each. Each lamp section is powered by the systems internal bussed 24V supply. A 15 mA current regulator circuit is provided for each of the four lamp sections. Each lamp output arrangement utilizes specific drive transistors to illuminate the appropriate section(s) of the lamp module to indicate an alarm of a particular field contact input. The following table defines the assignments for the different lamp output arrangements:

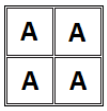
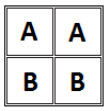
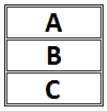
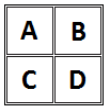
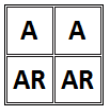
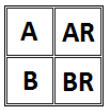
STYLE	Channel Drive Transistor(s) Used				LAMP ARRANGEMENT
	Q1	Q3	Q5	Q7	
1000 (Monalarm)	Channel A				
2000 (Binalarm)	Channel A		Channel B		
3000 (Trialarm)	Channel A	Channel B	Channel C	NOT USED	
4000 (Quadalarm)	Channel A	Channel B	Channel C	Channel D	
1000R (Redundant Monalarm)	Channel A Primary Source	Channel A Primary Source	Channel A Redundant Source	Channel A Redundant Source	
2000R (Redundant Binalarm)	Channel A Primary Source	Channel A Redundant Source	Channel B Primary Source	Channel B Redundant Source	

Table 7: Transistor Driver / LED

Two jumpers (J6 and J7) are provided on each alarm module to allow the selection of either primary source or redundant source for driving sections 2 and 4 of the lamp assembly. When an alarm module is configured as a non-redundant module (1000, 2000, 3000 and 4000) jumpers J6 & J7 must be set to “NR”. When an alarm module is configured as a redundant module (1000R and 2000R) jumpers J6 & J7 must be set to “R”.

2.6. Communication

2.6.1. CAN Bus Network

An internal communication bus is provided to allow communication from the interface module to and from each alarm module. The industry standard CAN bus is a highly reliable communication protocol that can transfer data at up to 1 M bits/s. The single interface module can communicate up to 100 alarm modules using the CAN bus protocol. If a system requires more alarm modules, additional interface modules can be added within a single chassis. Each physical CAN bus requires a termination resistor at both ends of the bus. The interface module provides one termination resistor at one end of the bus and the other termination resistor must be installed at the other end of the CAN bus. A unique alarm rear terminal assembly is utilized to provide a location for this second termination resistor. This rear terminal assembly can also be used to expand a system from one to multiple chassis. The maximum distance between two chassis or the maximum length of the CAN bus is limited to 10 feet. The cable used to expand the CAN bus from one chassis to another must be a shielded twisted pair type. The following figures depict a single chassis system and a multi chassis system:

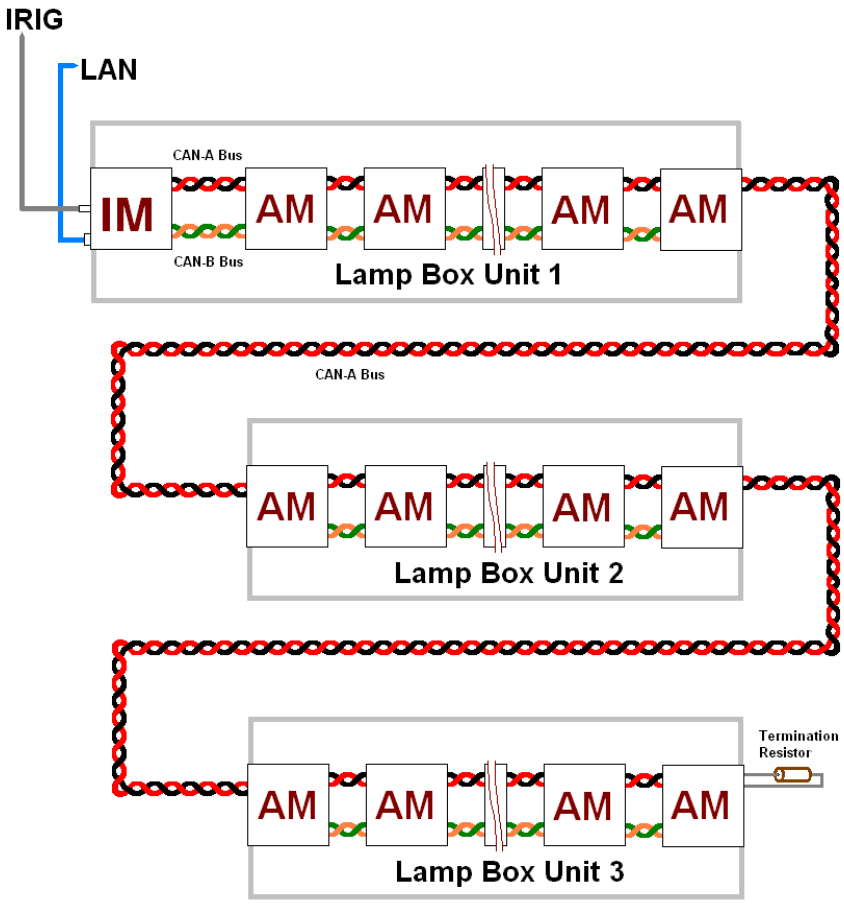


Illustration 23: Single CAN Bus no Redundant IM

Each single alarm module chassis contains a CAN bus address select switch bank of 8 switches and is set to a unique address for that module. This switch bank can be accessed from the front of the assembly for that module. Remove the Lamp Module card. There could be another card installed preventing access, remove and replace if necessary. Care must be take not to duplicate a CAN address within a CAN Bus Network. CAN bus address are factory set and can be found in a table later in this manual.

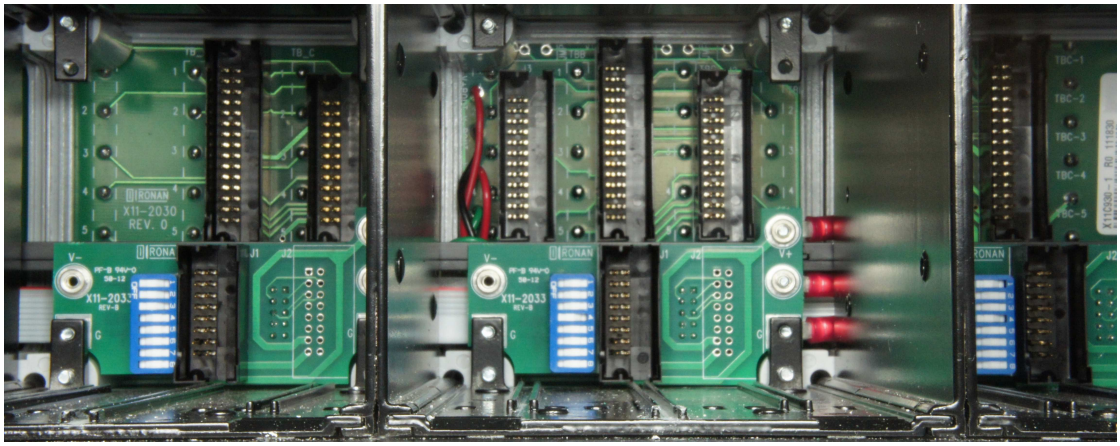


Illustration 24: CAN Address Switches

The illustration above shows the blue DIP switches located in each of the module chassis. For clarity, switch 1 is on top, and switch 8 is on the bottom.

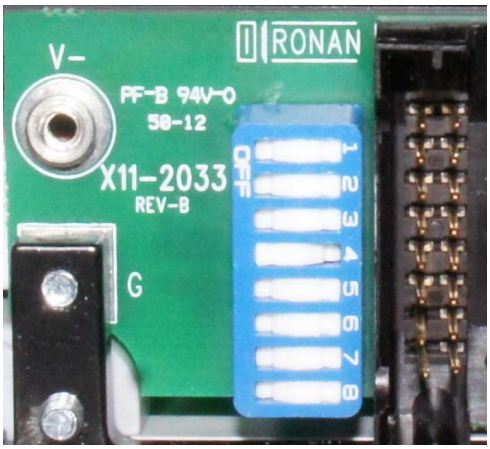


Illustration 25: CAN Address Switch Close Up

2.6.2. Redundant Configurations

An option to the X11CB is the addition of a second Interface Module on the same Lamp Cabinet known as a redundant Interface Module. The two interface modules operate independently over the same or different LANs. Each Interface Module talks to each of the Alarm Modules across a separate CAN bus. The redundant Interface Module communicates to a separate Alarm Module as a daughter card in the Host Alarm Module Unit.

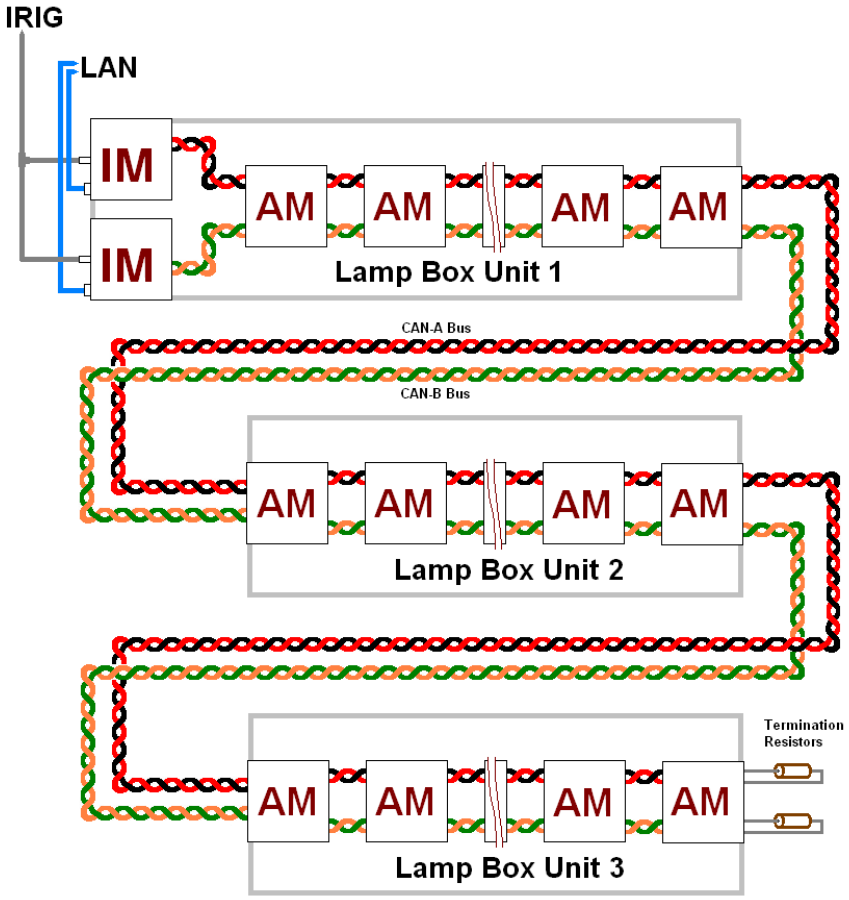


Illustration 26: Dual CAN Bus with Redundant IM

2.6.3. Input Response Time

The default response time of each point is 1 millisecond, but it can be modified using the X11CB operating software.

2.6.4. Summary of Jumper Settings

Jumper NO.	Description	Default Settings
J1	Rear edge board connector (532956-5)	
J2	CAN A, CAN B Rear edge board terminator. MODSEL termination (532956-2)	
J3	Mezzanine Board Interconnect (SSW-118-01-G-D)	Not Used
J4	J-Tag Interface (TSW-110-07-G-D)	
J5	Front panel interface connector (SSM-105-S-SH)	
J6	Front panel display redundancy selection	X11-1000 J6.2 - J6.3 X11-2000 J6.2 - J6.3 X11-3000 J6.2 - J6.3 X11-4000 J6.2 - J6.3 X11-1000R J6.1 - J6.2 X11-2000R J6.1 - J6.2
J7	Front panel display redundancy selection	X11-1000 J7.2 - J7.3 X11-2000 J7.2 - J7.3 X11-3000 J7.2 - J7.3 X11-4000 J7.2 - J7.3 X11-1000R J7.1 - J7.2 X11-2000R J7.1 - J7.2
J8	FC Voltage adapter interconnect PSS-09-01-TS (X11C842)	FCX - Minus & plus
J9	FC Voltage adapter interconnect PSS-09-01-TS (X11C842)	FCX - VRTN & VIN
J10	Polarity of field input contact A. Either Normally Open or Normally Closed.	Normally Open
J11	Polarity of field input contact B. Either Normally Open or Normally Closed.	Normally Open
J12	Polarity of field input contact C. Either Normally Open or Normally Closed.	Normally Open
J13	Polarity of field input contact B. Either Normally Open or Normally Closed.	Normally Open

Table 8: Summary of the X11-2047 Jumper Settings

2.7. Optional Auxiliary Contact Module: Part NO. X11-2049

The auxiliary contact module is available with a single, dual, triple, or quad relay circuit, accommodating the window density selected. The modules can be plugged in the front of the system and may be purchased initially or added later. The terminals for the contact outputs are furnished as a part of the system. Each relay provides a selectable form A or B type contact with a rating of 2A at 28 VDC. Normally open (Type A) or normally closed (Type B) contact is available for each alarm point at their respective rear terminal block terminals 5 and 6. The normal operation (NO/NC) can be changed on the auxiliary contact module at headers marked AUX-1, AUX-2, AUX-3, or AUX-4.

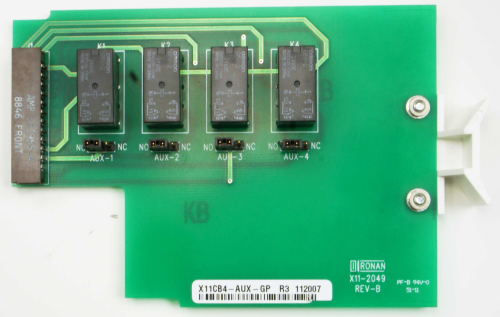


Illustration 27: X11-2049 Relay Board

2.8. Cables

2.8.1. X11CB to Remote Host- Cat5 Cable

ORDER INFORMATION

X11C940-L
(WHERE "L" IS REQUIRED LENGTH IN FEET.)

Illustration 28: CAT-5 Cable

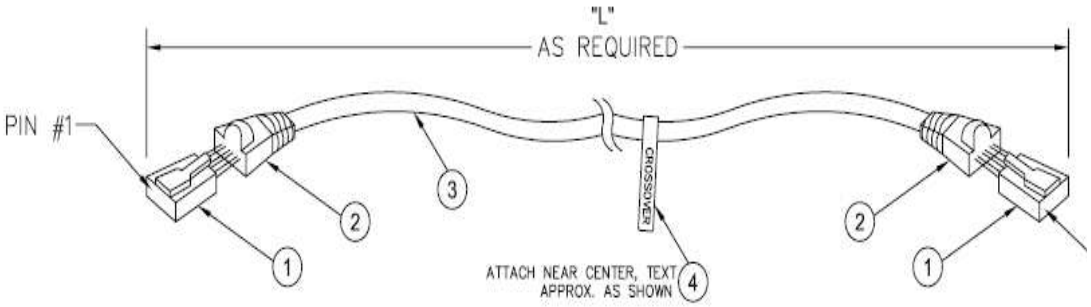


Illustration 29: CAT-5 Crossover Cable

X11CB RJ 45 Connector

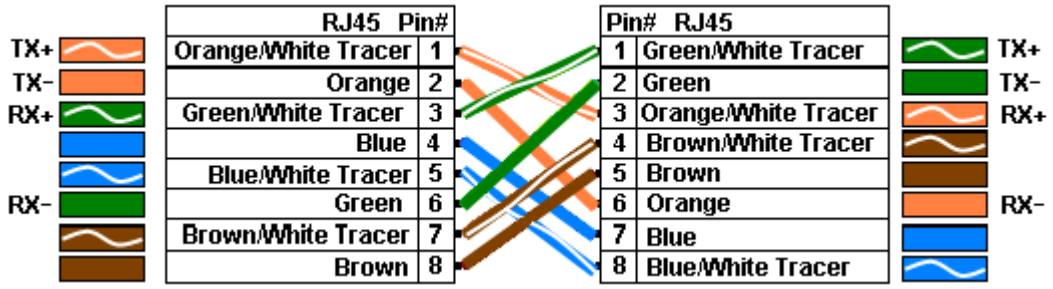


Illustration 30: Ethernet Crossover Cable

Illustration 31: Ethernet Patch Cable

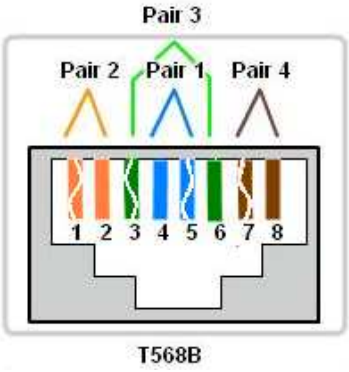


Illustration 32: RJ-45 Connector

3. Installation

3.1. Mounting of X11CB System

Refer the mounting diagrams for detail.

3.1.1. Mounting the Modules in the Alarm Cabinet

The annunciator is shipped with all of the alarm/lamp modules, auxiliary contact module(s) and interface module(s) installed in the cabinet, as specified by purchase order.

External horn relay(s), Reflash relay, Common alarm relay, Relay sockets are packed separately.

3.1.2. Mounting the Alarm Cabinet to the Panel

1). Position the X11CB alarm cabinet into the cutout hole on the panel

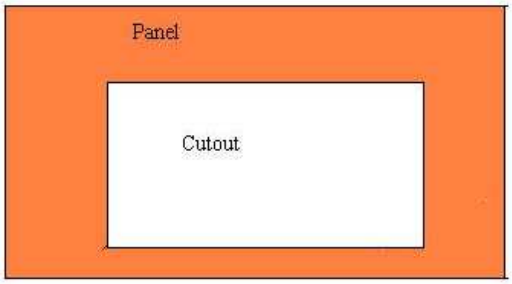


Illustration 33: Cutout Area of the Panel

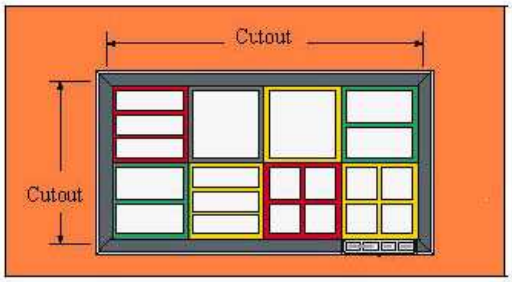


Illustration 34: Front View of the Cabinet after Positioning In the Panel

2). Insert the clamp part A into the groove of the clamp part B as shown in the figure below.

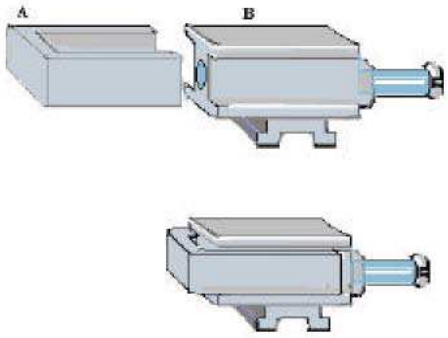


Illustration 35: Assembling the Clamp Parts

3). Place the first clamp into the center of the groove behind the extruded trim of the cabinet and then slide it into about one third from the top left corner of the cabinet.

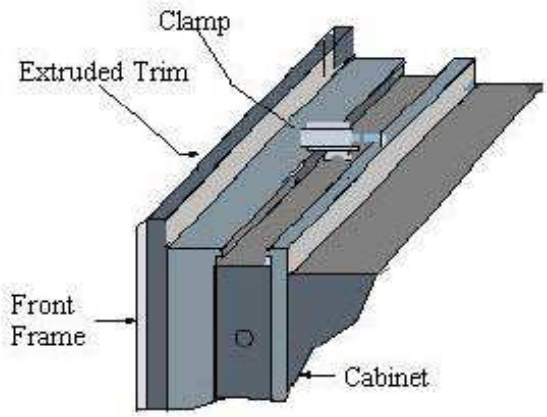


Illustration 36: Inserting the Clamp into the Top Center of Cabinet Groove

Place the second clamp into the center of the groove behind the extruded trim of the cabinet and then slide it into about one third from the top right corner of the cabinet. Tighten each jam screw to secure the cabinet to the panel cutout. Tighten the lock nuts on each screw.

The cutout size is approximately 0.5 inches larger than the Actual Height and Width giving 0.25 inch leeway around the perimeter.

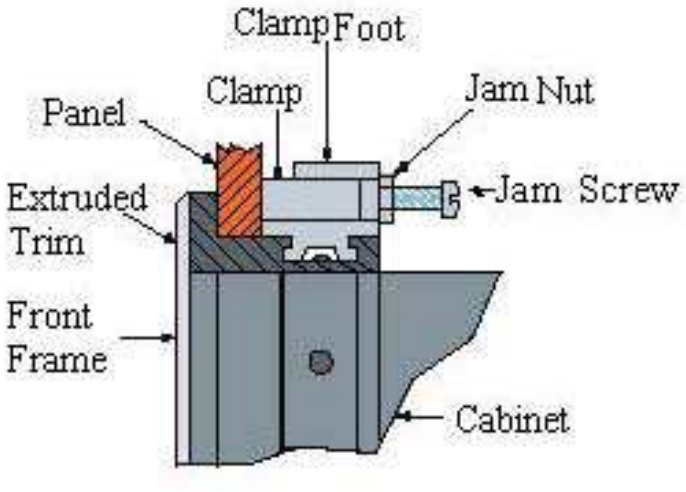
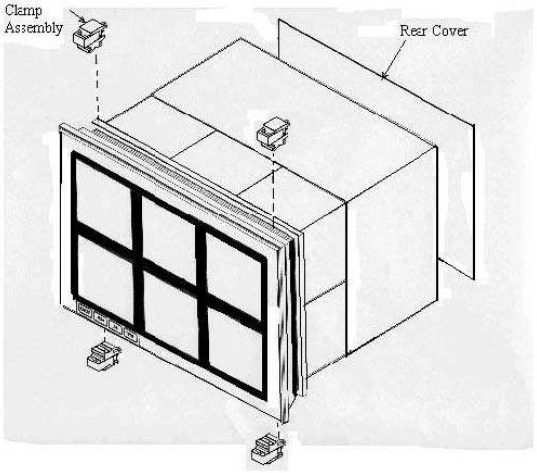


Illustration 37: Detail A

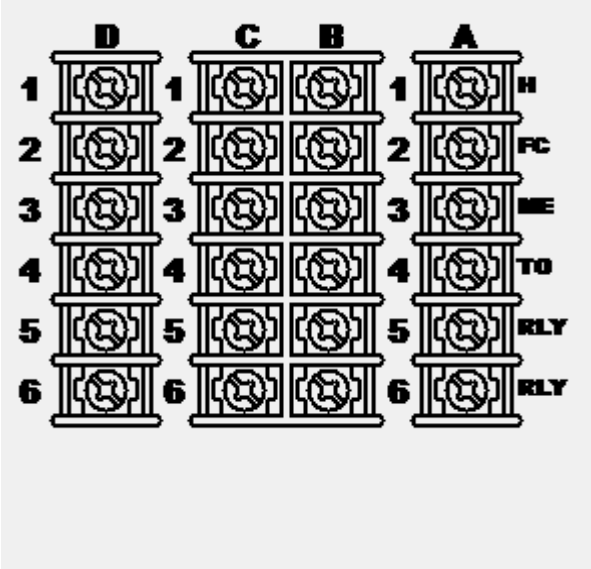
4). Repeat step three for installing the bottom two clamps.

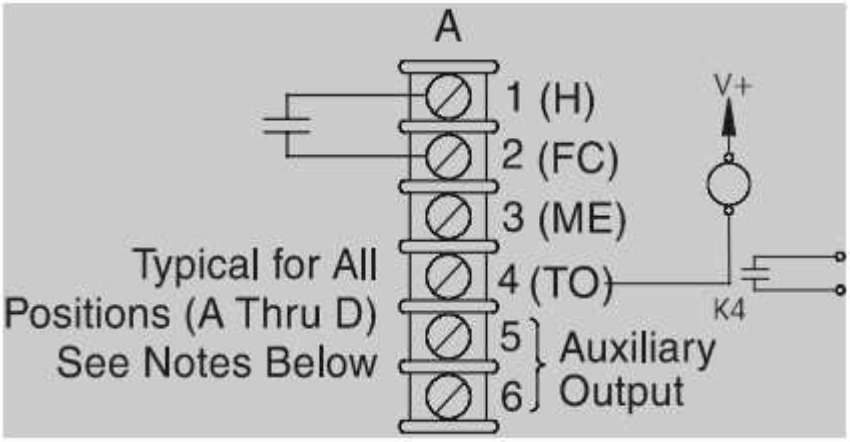


5. Refer to the wiring diagrams on the CD for wiring instructions.

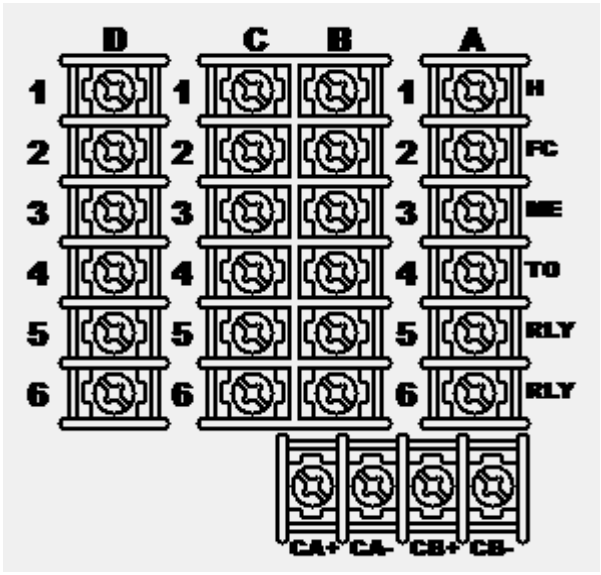
3.2. Alarm Module Terminal Backs

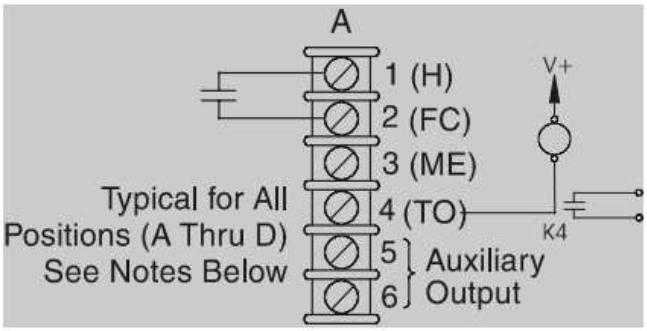
3.2.1. Common Alarm Module Terminal Block





3.2.2. CAN Bus Extender





Notes: CA+ CA- are either terminated with a 120 ohm resistor or continued on to the next X11CB cabinet with a twisted pair for use with a common Interface Module.

The CB terminals are the same as the CA terminals, either terminated or extended to the next cabinet. The CB or Can Bus 'B' is used with redundant Interface Modules. CB is extended/terminated regardless if there is a redundant IM.

3.2.3. Power Supply Distribution Terminal Block:

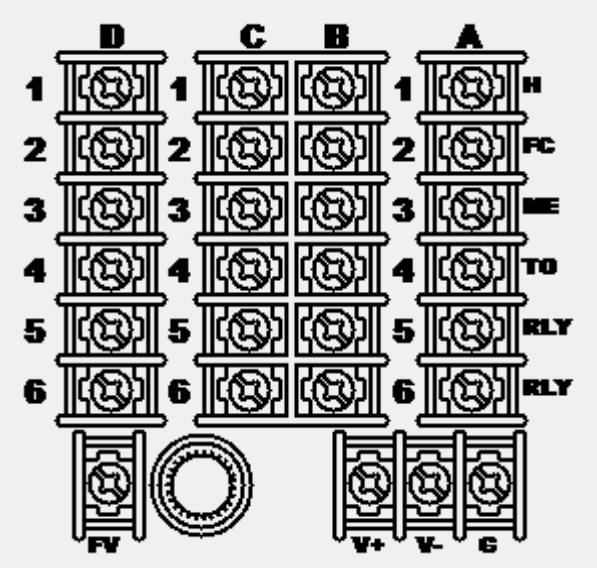


Illustration 38: X11-2039PL Power Filter

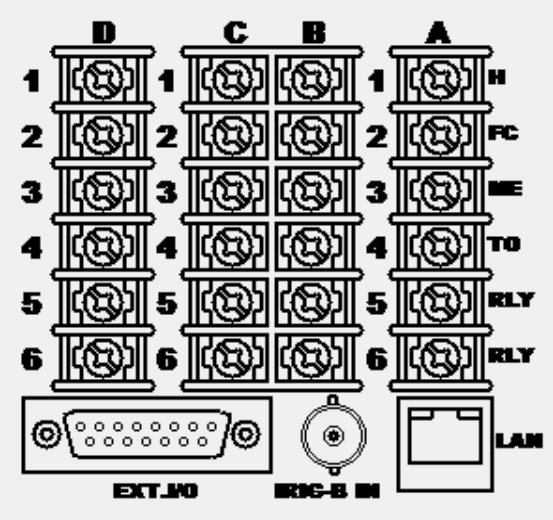
Note. The Power Supply Distribution terminal block is used for a fixed number of alarm terminals. Each Power Supply filter can accommodate up to 10 Amps @ 24VDC or 240 Watts.

The V+ and V- terminals are for the 24VDC supply input, and the G is for chassis ground or earth ground suitable for GFI detection.

The FV terminal is a 24VDC supply for dry Field Contact supply voltage.

The X11-2039 Power Filter Card will plug into the slot on the left side of this chassis with respect to the front.

3.2.4. Interface Module Terminal Block:



Notes. The Ext.I/O 15 pin female D connector connects the Switches and Outputs to the Ronan X11CB Interface Terminal (X11C921).

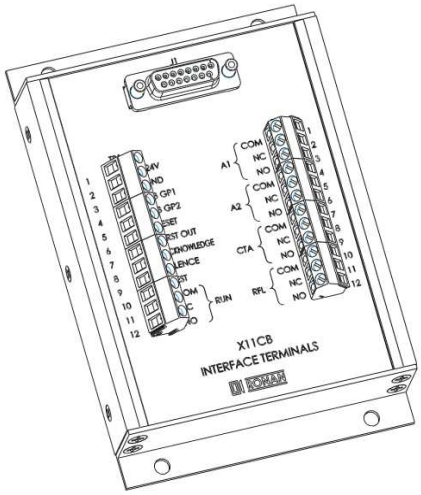


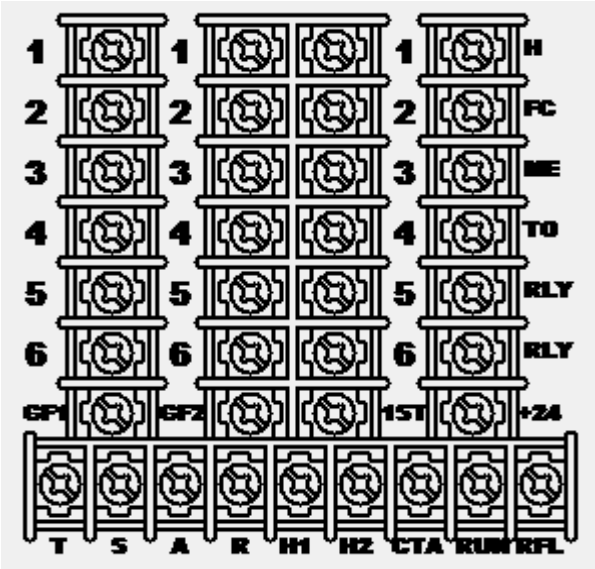
Illustration 39: X11CB Interface Terminal (X11C921)

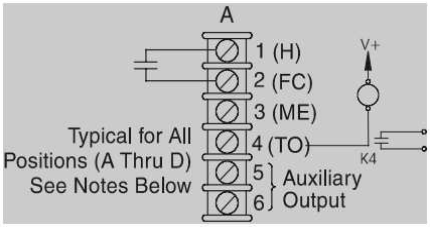
The IRIG-B (BNC) connects to a Time Source capable of providing a Sine wave amplitude modulated signal. The X11CB can support 2 styles of IRIG-B formats:

- IRIG-B Standard: The Interface Module does not read the year from the IRIG-B input. The User must set the year using the X11CB Configuration application.
- IRIG-B Ronan Enhanced - The Interface Module reads the year from the IRIG-B input.

See IRIG Setup later in this manual.

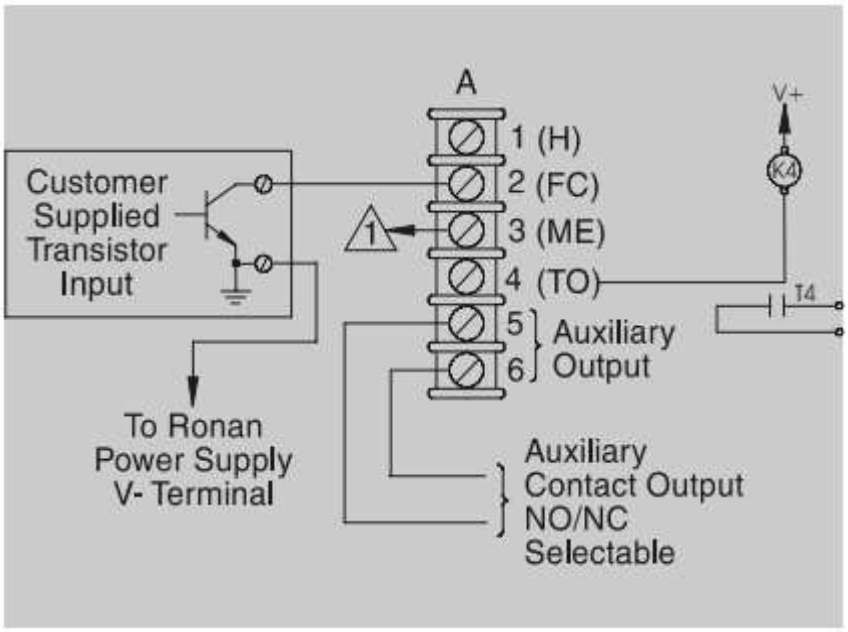
3.2.5. Interface Module I/O Callout Terminal Block





Terminal Abbreviation	Description	I/O
GF1 (F1)	General Function 1	Switch
GF2 (F2)	General Function 2	Switch
1ST (F3)	First Out Reset	Switch
“+24” (F4)	24 VDC OUT (source)	Switch
T	Test	Switch
S	Silence	Switch
A	Acknowledge	Switch
R	Reset	Switch
H1	Horn1	Output
H2	Horn2	Output
CTA	Common Trouble Alarm	Output
RUN (F5)	Run / Maintenance Indicator	Output
RFL (F6)	Reflash	Output

3.2.6. Customer Supplied Transistor Field Contact



3.3. Wiring Instructions

The following diagrams show rear terminal arrangements and wiring for the X11CB1000 system, X11CB2000 system, X11CB3000 system and the X11CB-4000 system. Incoming field wiring must be connected with copper conductors only, using 14-20 AWG wire. Field contact wiring must be connected with ring tongue terminals or locking fork lugs. Power wiring at the H (V+), N (-V) and G (GND) terminals must be torque to 4.5 pounds.

3.3.1. X11CB-1000 Rear Terminal Arrangement and Wiring for Dry Field Contacts

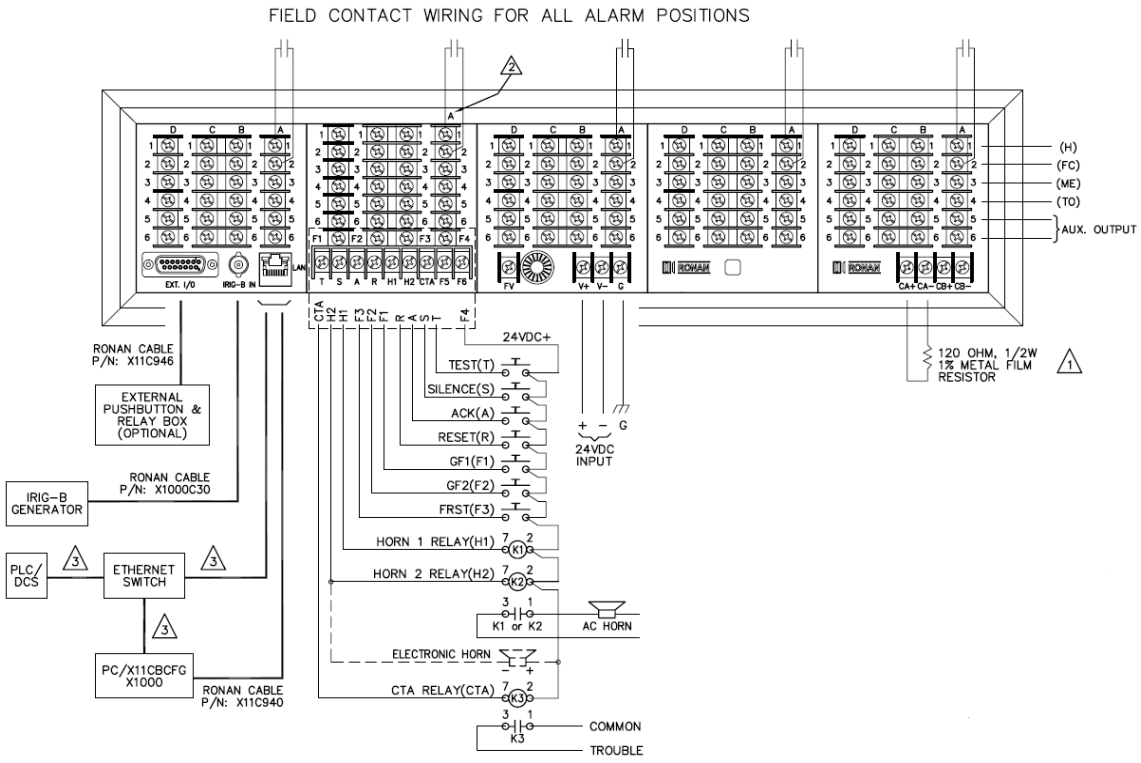


Figure 2-1 - X11CB-1000 Rear Terminal Wiring Diagram

3.3.2. X11CB-2000 Rear Terminal Arrangement and Wiring for Dry Field Contacts

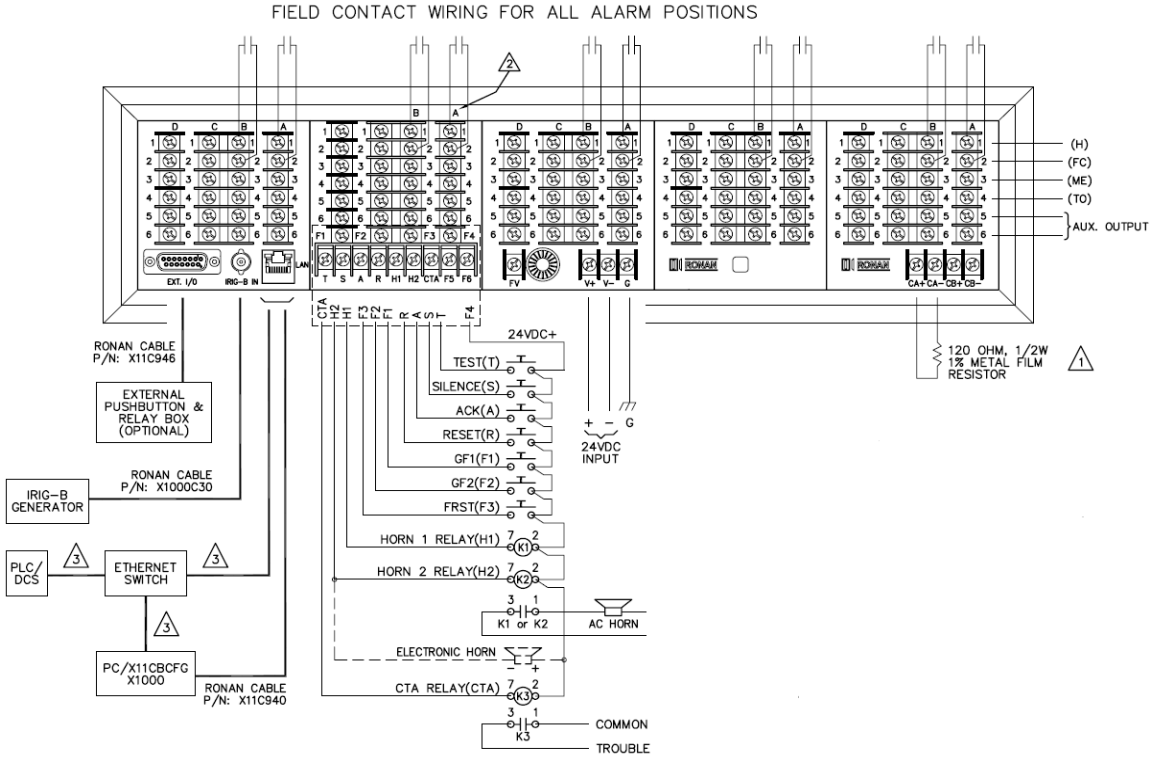


Figure 2-20 - X11CB-2000 Rear Terminal Wiring Diagram

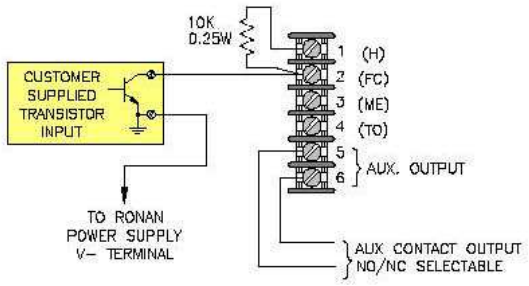


Figure 2-21 - Typical Transistor Input

3.3.3. X11CB-3000 Rear Terminal Arrangement and Wiring for Dry Field Contacts

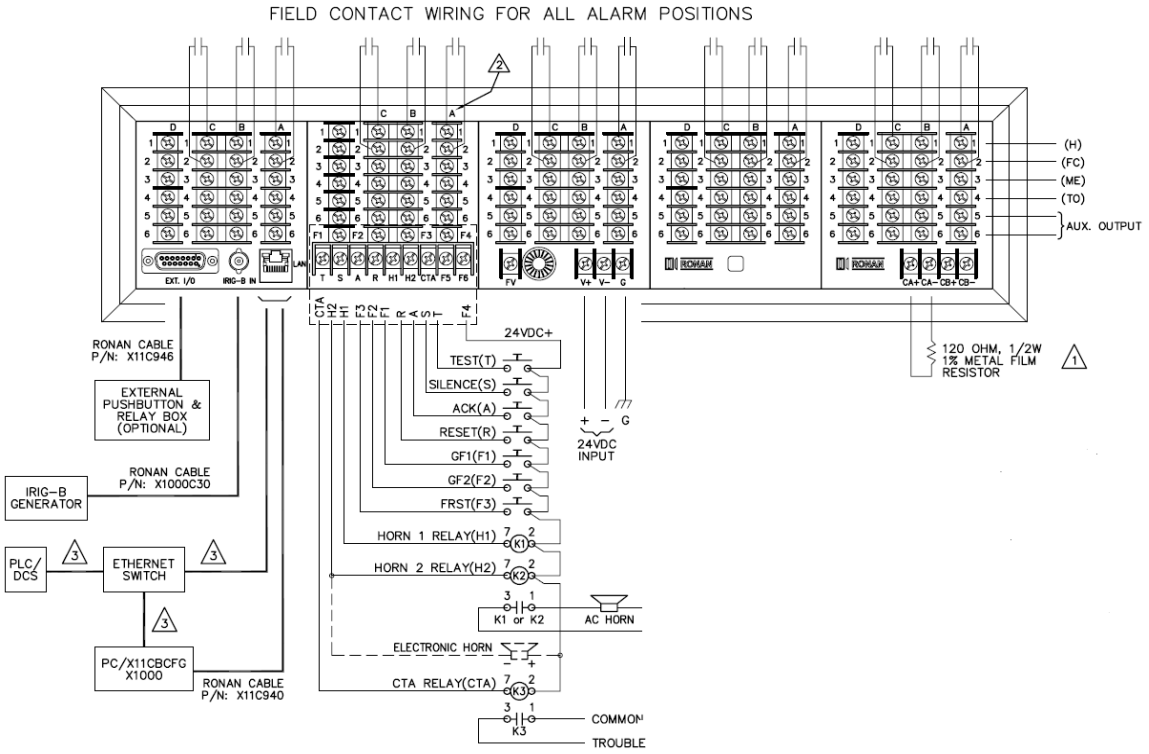


Figure 2-22 - X11CAB-3000 Rear Terminal Wiring Diagram

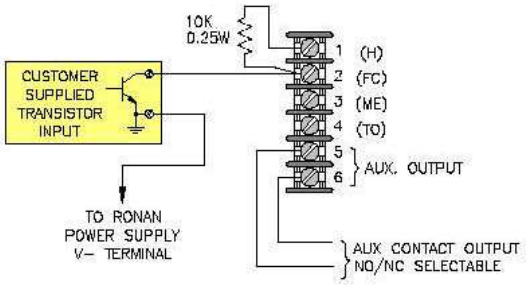


Figure 2-23 - Typical Transistor Input

3.3.4. X11CB-4000 Rear Terminal Arrangement and Wiring for Dry Field Contacts

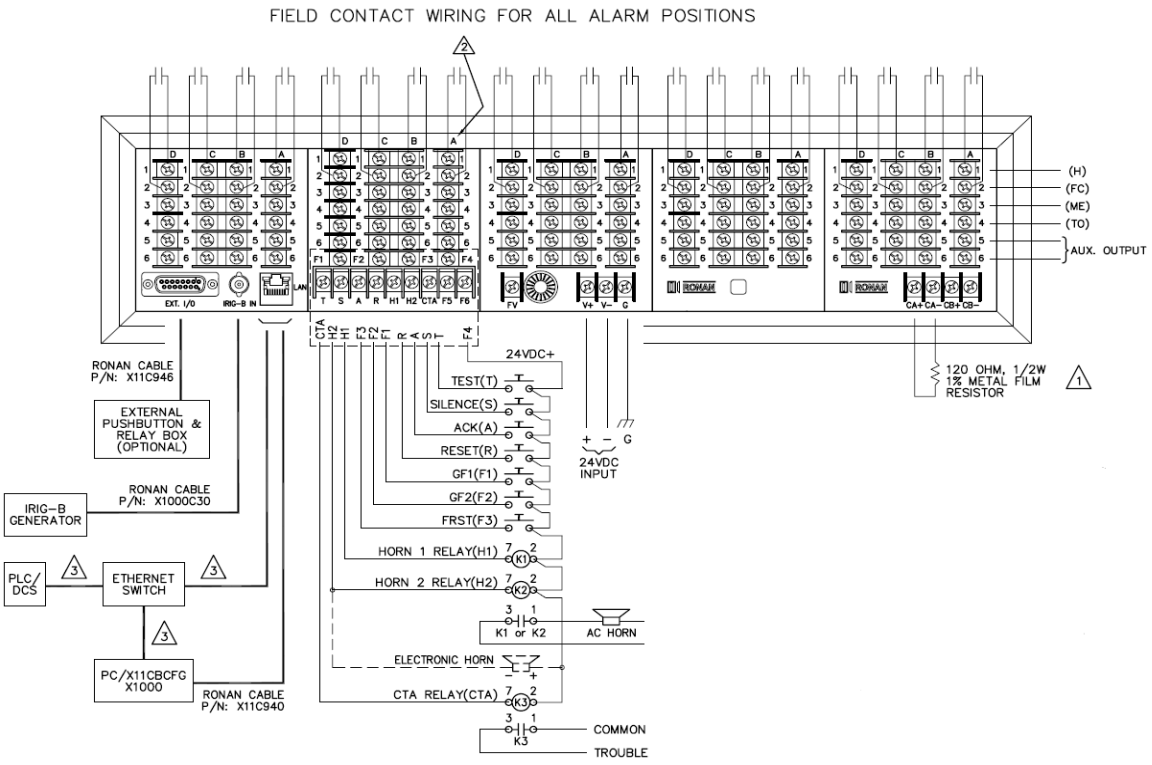


Figure 2-24 - X11CB-4000 Rear Terminal Wiring Diagram

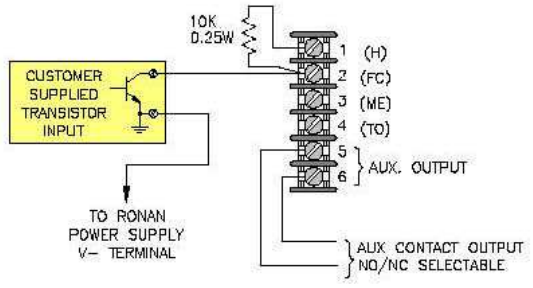
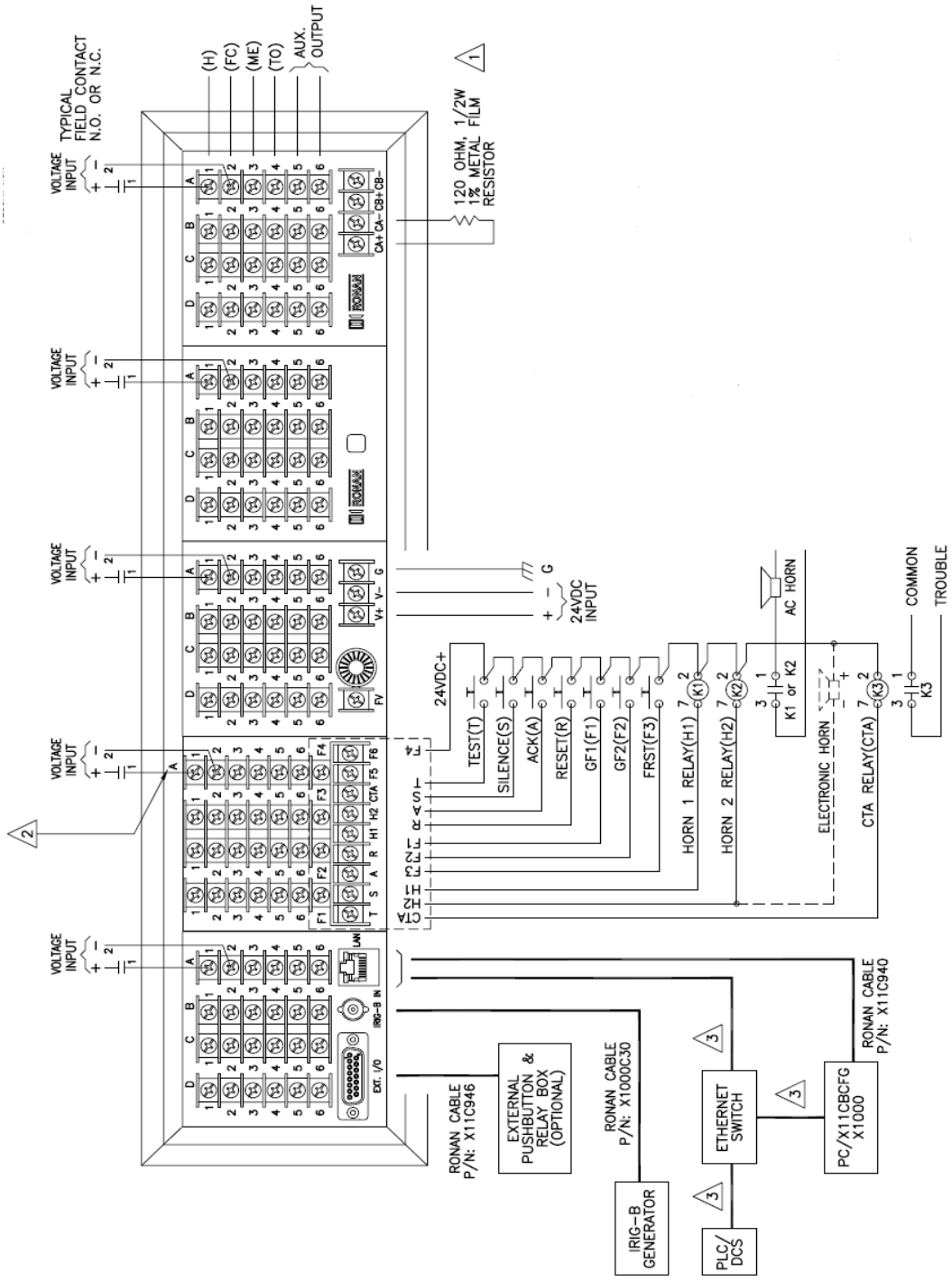
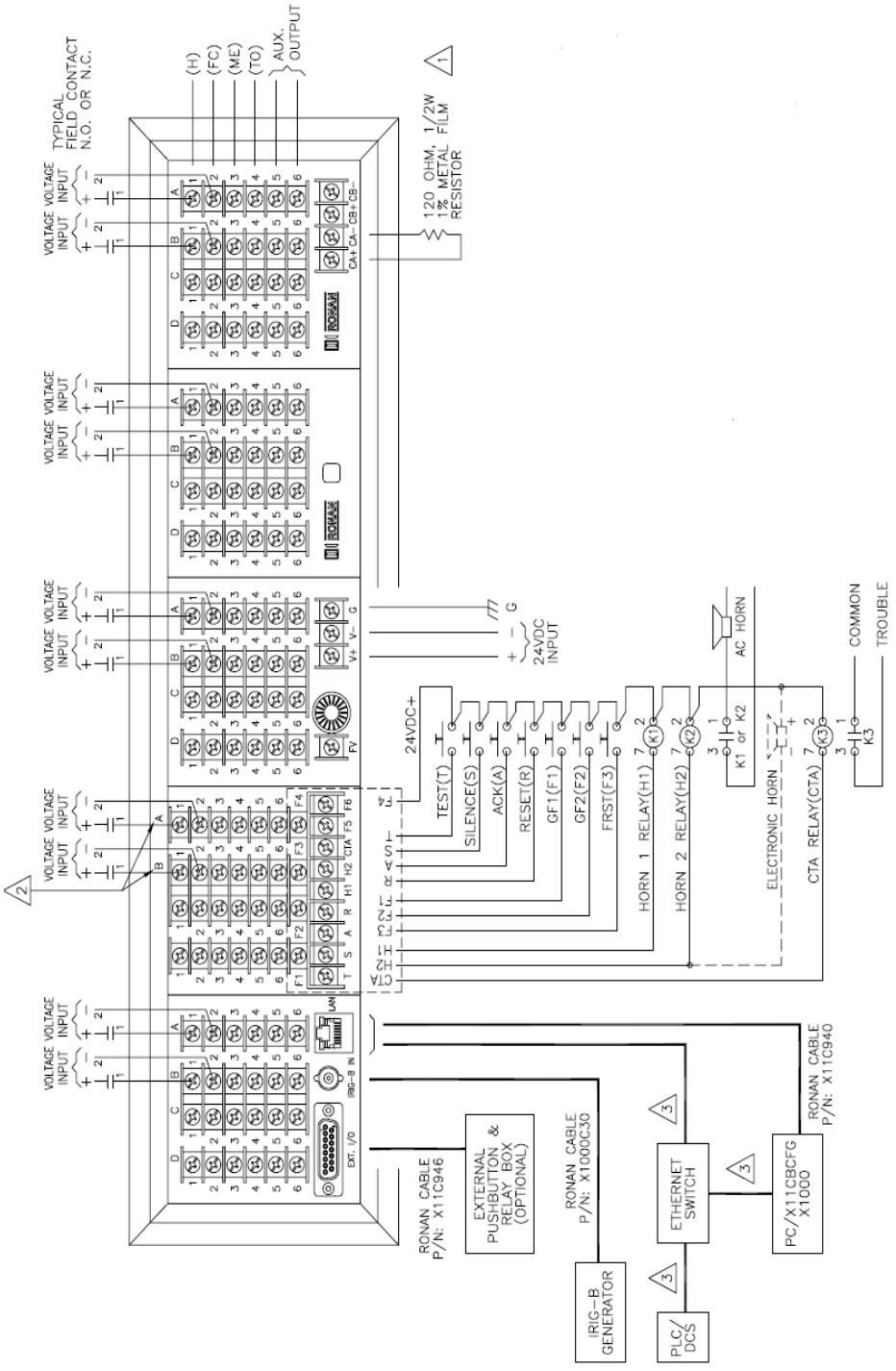


Figure 2-25 - Typical Transistor Input

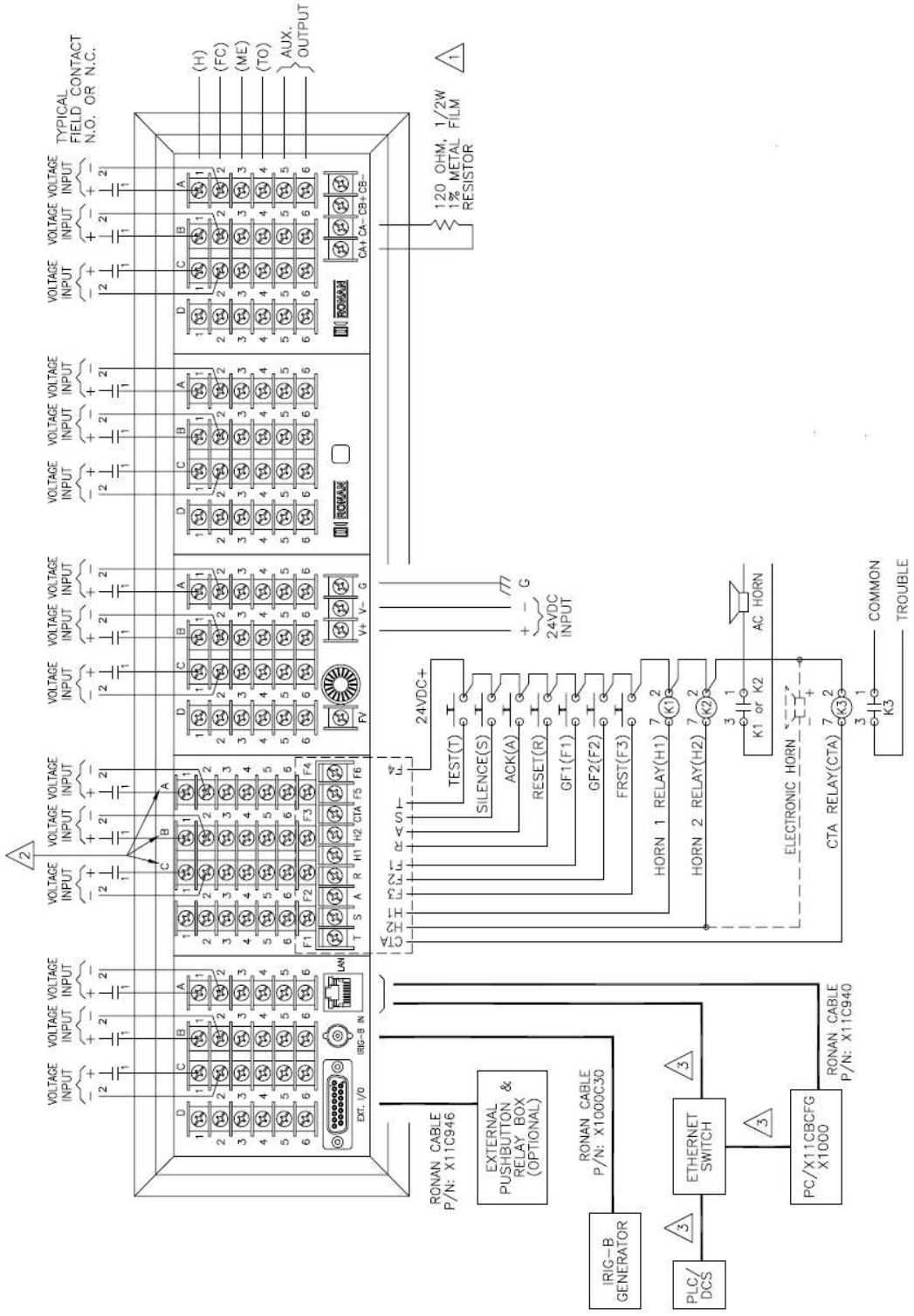
3.3.5. X11CB-1000 Rear Terminal Arrangement and Wiring for Live Contacts



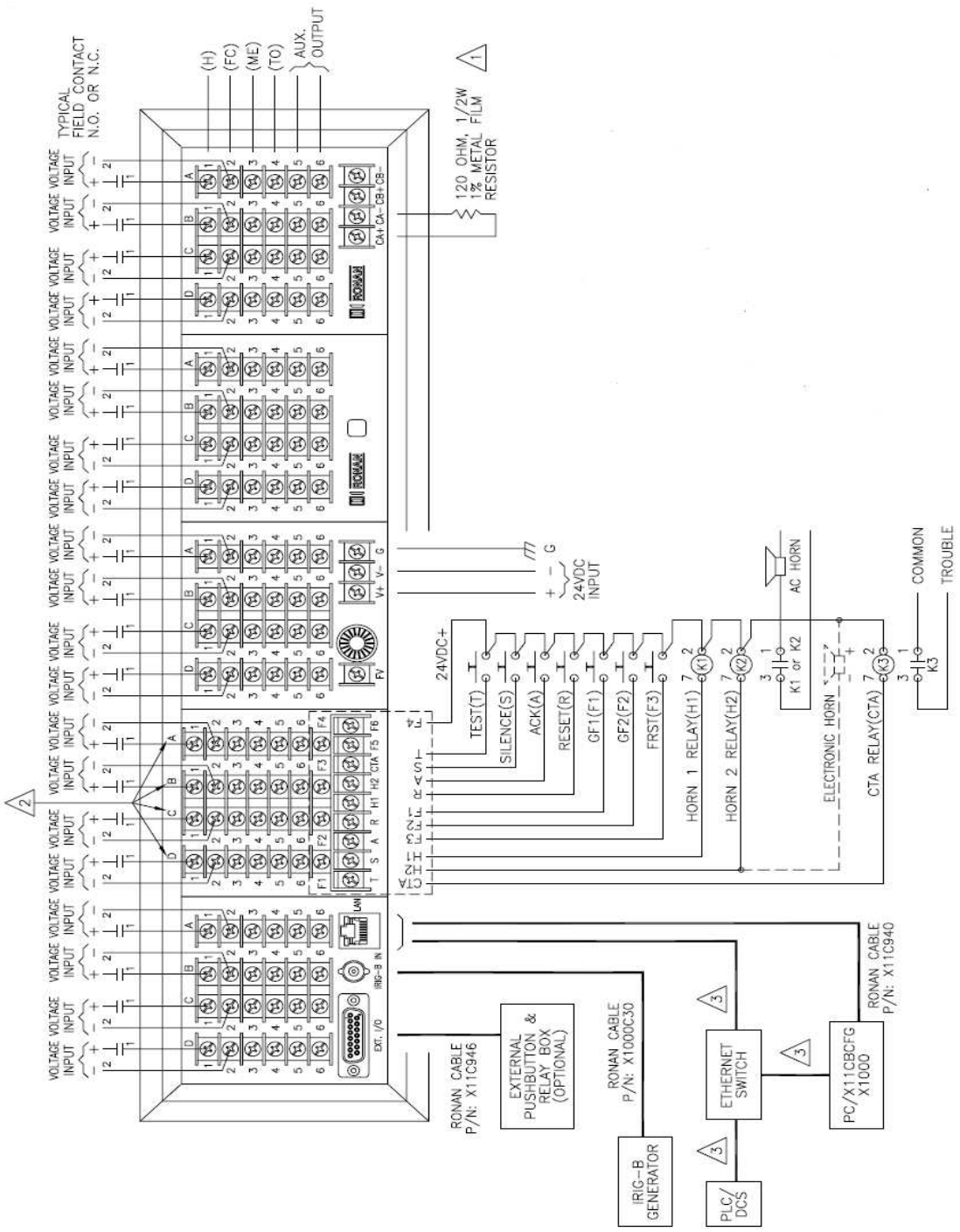
3.3.6. X11CB-2000 Rear Terminal Arrangement and Wiring for Live Contacts



3.3.7. X11CB-3000 Rear Terminal Arrangement and Wiring for Live Contacts



3.3.8. X11CB-4000 Rear Terminal Arrangement and Wiring for Live Contacts



Voltage Free Terminal Wiring Information's

(H) : Field contact voltage for dry contact
(FC) : Field contact return
(ME) : Connect all First out windows in a group.
(TO) : Transistor output driver
AUX OUT : Auxiliary output - N.O./N.C. selectable
(F1) : GF1 Push button input (Programmable inhibit function)
(F2) : GF2 Push button input (Programmable inhibit function)
(F3) : First out reset push button input
(F4) : 24 VDC +
(F5) : Run Transistor output drive
(F6) : Reflash transistor output drive
CTA : Common trouble transistor output drive

1 For internal bus expansion port, for multiple chassis, single or last chassis requires termination resistor.

2 Letter shown are for reference only, they are not on actual unit.

3 Ronan Cables
PVC Cable : X500C169
Plenum cable : X500C168

Live Terminal Wiring Information's

(H) : Field contact voltage for live input
(FC) : Field contact return
(ME) : Connect all First out windows in a group.
(TO) : Transistor output driver
AUX OUT : Auxiliary output - N.O./N.C. selectable
(F1) : GF1 Push button input (Programmable inhibit function)
(F2) : GF2 Push button input (Programmable inhibit function)
(F3) : First out reset push button input
(F4) : 24 VDC +
(F5) : Run Transistor output drive
(F6) : Reflash transistor output drive
CTA : Common trouble transistor output drive

1 For internal bus expansion port, for multiple chassis, single or last chassis requires termination resistor.

2 Letter show are for reference only, they are not on actual unit.

3 Ronan Cables
PVC Cable : X500C169
Plenum cable : X500C168

Alarm Terminal Inputs

Two basic types of terminal contacts are available.

i. Dry contact.

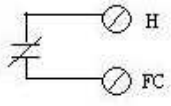


Figure 2-2 - WITH 24VDC SYSTEM POWER

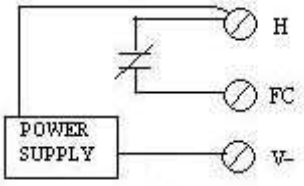
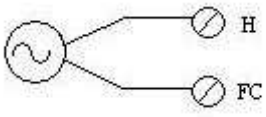


Figure 2-3 - WITH 24VDC, 48VDC, 125VDC, 250VDC OR 24VAC, 48VAC, 115VAC 240VAC FC SOURCE

FC source must be common to the system FC

ii. Opto-Coupled (Live Contact)



WITH FC SOURCE 24VDC, 48VDC, 125VDC, 250VDC OR 24VAC, 48VAC, 115VAC 240VAC

Each active alarm input must be wired to a customer's sensing device to set its alarm condition as either open or closed. The terminals on the alarm system for each alarm input are marked H and FC. The H terminal in the standard alarm system is the main system voltage that is supplied via a pull-up resistor on each alarm point. Each alarm input module is provided with a separate H terminal. When using a common H, it is important to jumper together the H terminals of the respective alarm cabinet modules to provide the correct amount of current source to the field contact.

The return wire from the field contact is wired to the FC terminal on each respective alarm module. Since the alarm system provides the power to the field contacts, it is important to verify that no other voltage source is present on either the H or FC terminals.

In general, the solid-state alarm system is a floating system. The V+ and V- should be verified as ungrounded

Power Supply

Verify the polarity of connection to the alarm systems. In large systems, verify that the wire sizes are efficient for high current use of the power leading to the alarm cabinets. To protect the larger alarm chassis, it is common to provide more than one input to the cabinet in which each section is provided with a separate filter, fuse and supply input terminals.

Converters

1. DC to DC Converter

- 48VDC input, 24VDC output, 200 watts
- 48VDC input, 24VDC output, 350 watts
- 125VDC or 115VDC input, 24VDC and 125VDC output, 500 watts

2. AC to DC Converter

- System Power Supply: Input 90 – 160 VAC 50/60Hz; 120-370VDC, Output 24VDC, Power 200 to 1000 Watts

- Input 125VDC or 115VAC, Output 24VDC and 125VDC, Power 500 Watts

In case of multiple supply of input, make the parallel V+ and V- connections.

3.4. Power Up

Inspect the hookup wiring to insure conformity with the schematic provided. Verify that ME terminals are connected to other ME terminals only.

Turn the power on.

CAUTION: Do not remove fuse when system is energized

Upon the power application, the flasher module within the system will automatically initiate reset cycle. If all the associated field contacts are in normal condition, the system should then be in a quiescent state with the horn(s) off and no lamps flashing.

Press the TEST button.

(Refer to the sequence charts on the CD for the expected results.)

3.5. Troubleshooting

3.5.1. General

- No light: Check for the power supply, Lamp Box fuse, burned out, broken or improperly seated bulbs.
- Not functioning alarm points: Make sure that the alarm modules are properly seated in their connector.
- Power supply fuse blows each time power is applied.
  - α. Check the Power Supply Parts List or the unit instrument tag for proper fuse size.
  - β. Remove the alarm system from the supply and try again. If fuse holds, double check polarity and reconnect. If the fuse still blows, remove all alarm modules and power filter card and try again. If the fuse blows at this point, the problem has been isolated to a short in the internal wiring.

3.5.2. Non-operating Alarm System

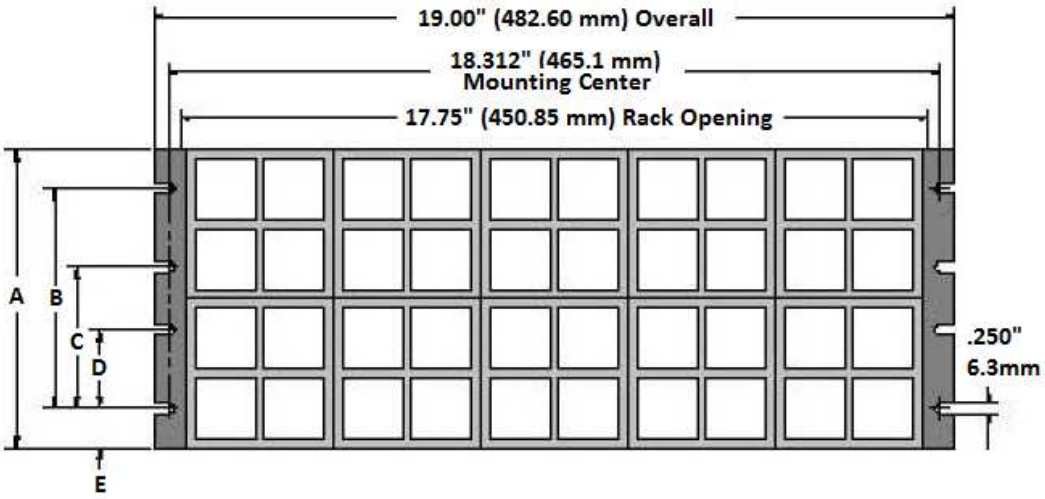
- Verify that the power source is functioning properly/
- The plus to minus voltage on the rear terminals is in the range of 18V to 28V.
- Verity each polarity.

3.6. Dimensions

Refer to the files saved on the enclosed CD ROM, *X11CB Drawings and Sequence Chart*, for other dimensions.

3.6.1. Models X11CB-RelayRack Mounted Series

Illustration 40: X11CB-RR Series -1000 -2000 -3000 –4000



Number of Windows		A Overall		B Dim		C Dim		D Dim		E Dim	
High	Wide	In	mm	In	mm	In	mm	In	mm	In	mm
2	10	3.50	88.90	0.25	5.40	3.00	76.20				
4	10	7.00	177.80	1.50	38.10	4.00	101.60				
6	10	10.50	266.70	1.50	38.10					7.50	190.50
8	10	14.00	355.60	1.50	38.10					11.00	279.40
10	10	17.50	444.50	0.88	22.20	4.12	104.80	11.62	295.30	15.75	400.10
12	10	21.00	533.40	1.50	38.10	5.25	133.40	12.75	323.90	18.00	457.20

Table 9: X11CB-RR Dimensions

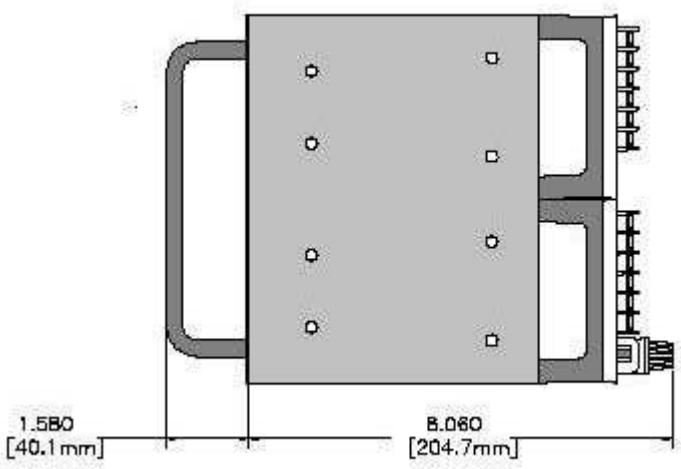


Figure 2-4 - Dimensional Information of X11CB RR (All Series)

Number of Modules	Width/Height		
	Inches	millimeters	U-Rack
2	7.00	177.80	4
3	10.50	266.70	6
4	14.00	355.60	8
5	17.50	444.50	10
6	21.00	533.40	12
7	24.50	622.30	14
8	28.00	711.20	16
9	31.50	800.10	18
10	35.00	889.00	20
11	38.50	977.90	22
12	42.00	1066.80	24
13	45.50	1155.70	26
14	49.00	1244.60	28
15	52.50	1333.50	30
16	56.00	1422.40	32
17	59.50	1511.30	34
18	63.00	1600.20	36
19	66.50	1689.10	38
20	70.00	1778.00	40

4. Basic Alarm Sequence letter designations

4.1. Option number designations

Option numbers can be used with the basic sequence letter designations to define many different sequence variations. This Standard makes use of the following option numbers to designate many of the common sequence variations. Other sequence variations are considered to be special and should be defined by sequence diagrams, sequence tables, or notes.

Option Number	Key Words	Description
1	Silence Push button	A separate push button is added to allow silencing the alarm audible device without affecting the visual displays.
2	Silence Interlock	Silence Interlock An interlock is added to require operation of the silence push button before alarms can be acknowledged.
3	First Out	An interlock is added to require Reset Interlock operation of the acknowledge push button before first out alarms can be reset by the first out reset push button
4	No Lock-In	The lock-in feature is deleted. Momentary alarms return to the normal sequence state without operation of the acknowledge push button.
5	No Flashing	The visual display flashing feature is deleted. New alarms have the same visual display indication as acknowledged alarms.
6	No Audible	The audible device is deleted.
7	Automatic	A time delay device is added to silence Alarm Silence the alarm audible device after a set time without affecting the visual displays.
8	Common Ringback	A common audible device is Audible used to call attention to both the alarm and ringback sequence states.
9	Automatic	A time delay device is added to silence Ringback Silence the ringback audible device after a set time without affecting the visual displays.
10	No Ringback Audible	The ringback audible device is deleted.
11	Common Ringback	A common type of flashing is used to Visual indicate both the alarm and ringback sequence states.
12	Automatic Momentary Ringback	Ringback sequence momentary alarms go to the ringback sequence state without operation of the acknowledge push button.
13	Dim Lamp Monitor	The visual display indication is dim in the normal sequence state to reveal lamp failure.
14	Lamp Test	Operation of the test push button tests the visual displays

Option Number	Key Words	Description
		only.

4.2. First out designations

First out annunciators are used to indicate which one of a group of alarm points operated first. To accomplish this, the visual display indication for the alarm point that operates first must be different from the visual display indication for subsequent alarm points in that group. only one first out alarm indication can exist in any one first out group.

Three methods for differentiating between first and subsequent alarms are in common use. Two make use of the usual sequence features for the first alarm and delete features for subsequent alarms. The third provides additional features to indicate first alarms. This Standard makes use of the following first out designations to designate the three methods.

First Out Designation	Key Words	Description
F1	No Subsequent Alarm State	Subsequent alarms appear in the acknowledged state. Subsequent visual displays do not flash. The audible device does not operate when subsequent alarms occur, unless still operating from the first alarm. The first out indication is reset by the acknowledge push button.
F2	No Subsequent Alarm Flashing	Subsequent visual displays do not flash. The audible device does not operate when subsequent alarms occur. The first out indication is reset by the acknowledge push button.
F3	First Out Flashing and Reset Push button	Additional types of flashing are added to identify new and acknowledged first alarms. A first out reset push button is added to reset the first out indication, whether the process condition has returned to normal or not.

First out sequences can be automatic reset or manual reset or can provide ringback indication when alarms return to normal. First out sequences are designated by a combination of the first out designation, the basic sequence letter designation, and option numbers.

First out sequence diagrams consist of an outer loop of actions and states associated with the first alarm and an inner loop associated with subsequent alarms. The two loops have a common normal state.

Not all of the possible first out sequences are readily available. In some cases, a particular first out sequence may be a standard design for only one manufacturer. Sequence designations for a range of first out sequences are listed below. Some of these use a silence pushbutton, option number 1, to silence the audible device while retaining the visual display indications in the alarm state—see 4.5, Option Number Designations. The sequences commonly available at the time of publication are indicated.

Key Words	Automatic Reset	Manual Reset	Ringback
No Subsequent Alarm State	F1A (Common)	F1M (Common)	F1R
No Subsequent Alarm State and Silence Push button	F1A-1 (Common)	F1M-1 (Common)	F1R-1
No Subsequent Alarm Flashing	F2A (Common)	F2M (Common)	F2R
No Subsequent Alarm Flashing and Silence Push button	F2A-1	F2M-1	F2R-1
First Out Flashing and Reset Push button	F3A	F3M	F3R

5. Data Conversion (Bin to Dec) Table

Switch Binary Address Equivalents
The following table shows numbers from 0000 0000_2 to 1111 1111_2.

SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1	Binary Equivalent	Hex Equivalent	Decimal Value
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	0000 0000	0x00	0
OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	0000 0001	0x01	1
OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	0000 0010	0x02	2
OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	0000 0011	0x03	3
OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	0000 0100	0x04	4
OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	0000 0101	0x05	5
OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	0000 0110	0x06	6
OFF	OFF	OFF	OFF	OFF	ON	ON	ON	0000 0111	0x07	7
OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	0000 1000	0x08	8
OFF	OFF	OFF	OFF	ON	OFF	OFF	ON	0000 1001	0x09	9
OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	0000 1010	0x0A	10
OFF	OFF	OFF	OFF	ON	OFF	ON	ON	0000 1011	0x0B	11
OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	0000 1100	0x0C	12
OFF	OFF	OFF	OFF	ON	ON	OFF	ON	0000 1101	0x0D	13
OFF	OFF	OFF	OFF	ON	ON	ON	OFF	0000 1110	0x0E	14
OFF	OFF	OFF	OFF	ON	ON	ON	ON	0000 1111	0x0F	15
OFF	**OFF**	**OFF**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**	**0001 0000**	**0x10**	**16**
OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	0001 0001	0x11	17
OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	0001 0010	0x12	18
OFF	OFF	OFF	ON	OFF	OFF	ON	ON	0001 0011	0x13	19
OFF	OFF	OFF	ON	OFF	ON	OFF	OFF	0001 0100	0x14	20
OFF	OFF	OFF	ON	OFF	ON	OFF	ON	0001 0101	0x15	21
OFF	OFF	OFF	ON	OFF	ON	ON	OFF	0001 0110	0x16	22
OFF	OFF	OFF	ON	OFF	ON	ON	ON	0001 0111	0x17	23
OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	0001 1000	0x18	24
OFF	OFF	OFF	ON	ON	OFF	OFF	ON	0001 1001	0x19	25
OFF	OFF	OFF	ON	ON	OFF	ON	OFF	0001 1010	0x1A	26
OFF	OFF	OFF	ON	ON	OFF	ON	ON	0001 1011	0x1B	27
OFF	OFF	OFF	ON	ON	ON	OFF	OFF	0001 1100	0x1C	28
OFF	OFF	OFF	ON	ON	ON	OFF	ON	0001 1101	0x1D	29
OFF	OFF	OFF	ON	ON	ON	ON	OFF	0001 1110	0x1E	30
OFF	OFF	OFF	ON	ON	ON	ON	ON	0001 1111	0x1F	31
OFF	**OFF**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**0010 0000**	**0x20**	**32**
OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	0010 0001	0x21	33
OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	0010 0010	0x22	34
OFF	OFF	ON	OFF	OFF	OFF	ON	ON	0010 0011	0x23	35
OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	0010 0100	0x24	36
OFF	OFF	ON	OFF	OFF	ON	OFF	ON	0010 0101	0x25	37
OFF	OFF	ON	OFF	OFF	ON	ON	OFF	0010 0110	0x26	38
OFF	OFF	ON	OFF	OFF	ON	ON	ON	0010 0111	0x27	39
OFF	OFF	ON	OFF	ON	OFF	OFF	OFF	0010 1000	0x28	40

SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1	Binary Equivalent	Hex Equivalent	Decimal Value
OFF	OFF	ON	OFF	ON	OFF	OFF	ON	0010 1001	0x29	41
OFF	OFF	ON	OFF	ON	OFF	ON	OFF	0010 1010	0x2A	42
OFF	OFF	ON	OFF	ON	OFF	ON	ON	0010 1011	0x2B	43
OFF	OFF	ON	OFF	ON	ON	OFF	OFF	0010 1100	0x2C	44
OFF	OFF	ON	OFF	ON	ON	OFF	ON	0010 1101	0x2D	45
OFF	OFF	ON	OFF	ON	ON	ON	OFF	0010 1110	0x2E	46
OFF	OFF	ON	OFF	ON	ON	ON	ON	0010 1111	0x2F	47
OFF	**OFF**	ON	ON	**OFF**	**OFF**	**OFF**	**OFF**	**0011 0000**	**0x30**	**48**
OFF	OFF	ON	ON	OFF	OFF	OFF	ON	0011 0001	0x31	49
OFF	OFF	ON	ON	OFF	OFF	ON	OFF	0011 0010	0x32	50
OFF	OFF	ON	ON	OFF	OFF	ON	ON	0011 0011	0x33	51
OFF	OFF	ON	ON	OFF	ON	OFF	OFF	0011 0100	0x34	52
OFF	OFF	ON	ON	OFF	ON	OFF	ON	0011 0101	0x35	53
OFF	OFF	ON	ON	OFF	ON	ON	OFF	0011 0110	0x36	54
OFF	OFF	ON	ON	OFF	ON	ON	ON	0011 0111	0x37	55
OFF	OFF	ON	ON	ON	OFF	OFF	OFF	0011 1000	0x38	56
OFF	OFF	ON	ON	ON	OFF	OFF	ON	0011 1001	0x39	57
OFF	OFF	ON	ON	ON	OFF	ON	OFF	0011 1010	0x3A	58
OFF	OFF	ON	ON	ON	OFF	ON	ON	0011 1011	0x3B	59
OFF	OFF	ON	ON	ON	ON	OFF	OFF	0011 1100	0x3C	60
OFF	OFF	ON	ON	ON	ON	OFF	ON	0011 1101	0x3D	61
OFF	OFF	ON	ON	ON	ON	ON	OFF	0011 1110	0x3E	62
OFF	OFF	ON	ON	ON	ON	ON	ON	0011 1111	0x3F	63
OFF	ON	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**0100 0000**	**0x40**	**64**
OFF	ON	OFF	OFF	OFF	OFF	OFF	ON	0100 0001	0x41	65
OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	0100 0010	0x42	66
OFF	ON	OFF	OFF	OFF	OFF	ON	ON	0100 0011	0x43	67
OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	0100 0100	0x44	68
OFF	ON	OFF	OFF	OFF	ON	OFF	ON	0100 0101	0x45	69
OFF	ON	OFF	OFF	OFF	ON	ON	OFF	0100 0110	0x46	70
OFF	ON	OFF	OFF	OFF	ON	ON	ON	0100 0111	0x47	71
OFF	ON	OFF	OFF	ON	OFF	OFF	OFF	0100 1000	0x48	72
OFF	ON	OFF	OFF	ON	OFF	OFF	ON	0100 1001	0x49	73
OFF	ON	OFF	OFF	ON	OFF	ON	OFF	0100 1010	0x4A	74
OFF	ON	OFF	OFF	ON	OFF	ON	ON	0100 1011	0x4B	75
OFF	ON	OFF	OFF	ON	ON	OFF	OFF	0100 1100	0x4C	76
OFF	ON	OFF	OFF	ON	ON	OFF	ON	0100 1101	0x4D	77
OFF	ON	OFF	OFF	ON	ON	ON	OFF	0100 1110	0x4E	78
OFF	ON	OFF	OFF	ON	ON	ON	ON	0100 1111	0x4F	79
OFF	ON	**OFF**	ON	**OFF**	**OFF**	**OFF**	**OFF**	**0101 0000**	**0x50**	**80**
OFF	ON	OFF	ON	OFF	OFF	OFF	ON	0101 0001	0x51	81
OFF	ON	OFF	ON	OFF	OFF	ON	OFF	0101 0010	0x52	82
OFF	ON	OFF	ON	OFF	OFF	ON	ON	0101 0011	0x53	83
OFF	ON	OFF	ON	OFF	ON	OFF	OFF	0101 0100	0x54	84
OFF	ON	OFF	ON	OFF	ON	OFF	ON	0101 0101	0x55	85
OFF	ON	OFF	ON	OFF	ON	ON	OFF	0101 0110	0x56	86
OFF	ON	OFF	ON	OFF	ON	ON	ON	0101 0111	0x57	87
OFF	ON	OFF	ON	ON	OFF	OFF	OFF	0101 1000	0x58	88

SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1	Binary Equivalent	Hex Equivalent	Decimal Value
OFF	ON	OFF	ON	ON	OFF	OFF	ON	0101 1001	0x59	89
OFF	ON	OFF	ON	ON	OFF	ON	OFF	0101 1010	0x5A	90
OFF	ON	OFF	ON	ON	OFF	ON	ON	0101 1011	0x5B	91
OFF	ON	OFF	ON	ON	ON	OFF	OFF	0101 1100	0x5C	92
OFF	ON	OFF	ON	ON	ON	OFF	ON	0101 1101	0x5D	93
OFF	ON	OFF	ON	ON	ON	ON	OFF	0101 1110	0x5E	94
OFF	ON	OFF	ON	ON	ON	ON	ON	0101 1111	0x5F	95
OFF	ON	ON	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**0110 0000**	**0x60**	**96**
OFF	ON	ON	OFF	OFF	OFF	OFF	ON	0110 0001	0x61	97
OFF	ON	ON	OFF	OFF	OFF	ON	OFF	0110 0010	0x62	98
OFF	ON	ON	OFF	OFF	OFF	ON	ON	0110 0011	0x63	99
OFF	ON	ON	OFF	OFF	ON	OFF	OFF	0110 0100	0x64	100
OFF	ON	ON	OFF	OFF	ON	OFF	ON	0110 0101	0x65	101
OFF	ON	ON	OFF	OFF	ON	ON	OFF	0110 0110	0x66	102
OFF	ON	ON	OFF	OFF	ON	ON	ON	0110 0111	0x67	103
OFF	ON	ON	OFF	ON	OFF	OFF	OFF	0110 1000	0x68	104
OFF	ON	ON	OFF	ON	OFF	OFF	ON	0110 1001	0x69	105
OFF	ON	ON	OFF	ON	OFF	ON	OFF	0110 1010	0x6A	106
OFF	ON	ON	OFF	ON	OFF	ON	ON	0110 1011	0x6B	107
OFF	ON	ON	OFF	ON	ON	OFF	OFF	0110 1100	0x6C	108
OFF	ON	ON	OFF	ON	ON	OFF	ON	0110 1101	0x6D	109
OFF	ON	ON	OFF	ON	ON	ON	OFF	0110 1110	0x6E	110
OFF	ON	ON	OFF	ON	ON	ON	ON	0110 1111	0x6F	111
OFF	ON	ON	ON	**OFF**	**OFF**	**OFF**	**OFF**	**0111 0000**	**0x70**	**112**
OFF	ON	ON	ON	OFF	OFF	OFF	ON	0111 0001	0x71	113
OFF	ON	ON	ON	OFF	OFF	ON	OFF	0111 0010	0x72	114
OFF	ON	ON	ON	OFF	OFF	ON	ON	0111 0011	0x73	115
OFF	ON	ON	ON	OFF	ON	OFF	OFF	0111 0100	0x74	116
OFF	ON	ON	ON	OFF	ON	OFF	ON	0111 0101	0x75	117
OFF	ON	ON	ON	OFF	ON	ON	OFF	0111 0110	0x76	118
OFF	ON	ON	ON	OFF	ON	ON	ON	0111 0111	0x77	119
OFF	ON	ON	ON	ON	OFF	OFF	OFF	0111 1000	0x78	120
OFF	ON	ON	ON	ON	OFF	OFF	ON	0111 1001	0x79	121
OFF	ON	ON	ON	ON	OFF	ON	OFF	0111 1010	0x7A	122
OFF	ON	ON	ON	ON	OFF	ON	ON	0111 1011	0x7B	123
OFF	ON	ON	ON	ON	ON	OFF	OFF	0111 1100	0x7C	124
OFF	ON	ON	ON	ON	ON	OFF	ON	0111 1101	0x7D	125
OFF	ON	ON	ON	ON	ON	ON	OFF	0111 1110	0x7E	126
OFF	ON	ON	ON	ON	ON	ON	ON	0111 1111	0x7F	127
ON	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**1000 0000**	**0x80**	**128**
ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	1000 0001	0x81	129
ON	OFF	OFF	OFF	OFF	OFF	ON	OFF	1000 0010	0x82	130
ON	OFF	OFF	OFF	OFF	OFF	ON	ON	1000 0011	0x83	131
ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	1000 0100	0x84	132
ON	OFF	OFF	OFF	OFF	ON	OFF	ON	1000 0101	0x85	133
ON	OFF	OFF	OFF	OFF	ON	ON	OFF	1000 0110	0x86	134
ON	OFF	OFF	OFF	OFF	ON	ON	ON	1000 0111	0x87	135
ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	1000 1000	0x88	136

SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1	Binary Equivalent	Hex Equivalent	Decimal Value
ON	OFF	OFF	OFF	ON	OFF	OFF	ON	1000 1001	0x89	137
ON	OFF	OFF	OFF	ON	OFF	ON	OFF	1000 1010	0x8A	138
ON	OFF	OFF	OFF	ON	OFF	ON	ON	1000 1011	0x8B	139
ON	OFF	OFF	OFF	ON	ON	OFF	OFF	1000 1100	0x8C	140
ON	OFF	OFF	OFF	ON	ON	OFF	ON	1000 1101	0x8D	141
ON	OFF	OFF	OFF	ON	ON	ON	OFF	1000 1110	0x8E	142
ON	OFF	OFF	OFF	ON	ON	ON	ON	1000 1111	0x8F	143
ON	**OFF**	**OFF**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**	**1001 0000**	**0x90**	**144**
ON	OFF	OFF	ON	OFF	OFF	OFF	ON	1001 0001	0x91	145
ON	OFF	OFF	ON	OFF	OFF	ON	OFF	1001 0010	0x92	146
ON	OFF	OFF	ON	OFF	OFF	ON	ON	1001 0011	0x93	147
ON	OFF	OFF	ON	OFF	ON	OFF	OFF	1001 0100	0x94	148
ON	OFF	OFF	ON	OFF	ON	OFF	ON	1001 0101	0x95	149
ON	OFF	OFF	ON	OFF	ON	ON	OFF	1001 0110	0x96	150
ON	OFF	OFF	ON	OFF	ON	ON	ON	1001 0111	0x97	151
ON	OFF	OFF	ON	ON	OFF	OFF	OFF	1001 1000	0x98	152
ON	OFF	OFF	ON	ON	OFF	OFF	ON	1001 1001	0x99	153
ON	OFF	OFF	ON	ON	OFF	ON	OFF	1001 1010	0x9A	154
ON	OFF	OFF	ON	ON	OFF	ON	ON	1001 1011	0x9B	155
ON	OFF	OFF	ON	ON	ON	OFF	OFF	1001 1100	0x9C	156
ON	OFF	OFF	ON	ON	ON	OFF	ON	1001 1101	0x9D	157
ON	OFF	OFF	ON	ON	ON	ON	OFF	1001 1110	0x9E	158
ON	OFF	OFF	ON	ON	ON	ON	ON	1001 1111	0x9F	159
ON	**OFF**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**1010 0000**	**0xA0**	**160**
ON	OFF	ON	OFF	OFF	OFF	OFF	ON	1010 0001	0xA1	161
ON	OFF	ON	OFF	OFF	OFF	ON	OFF	1010 0010	0xA2	162
ON	OFF	ON	OFF	OFF	OFF	ON	ON	1010 0011	0xA3	163
ON	OFF	ON	OFF	OFF	ON	OFF	OFF	1010 0100	0xA4	164
ON	OFF	ON	OFF	OFF	ON	OFF	ON	1010 0101	0xA5	165
ON	OFF	ON	OFF	OFF	ON	ON	OFF	1010 0110	0xA6	166
ON	OFF	ON	OFF	OFF	ON	ON	ON	1010 0111	0xA7	167
ON	OFF	ON	OFF	ON	OFF	OFF	OFF	1010 1000	0xA8	168
ON	OFF	ON	OFF	ON	OFF	OFF	ON	1010 1001	0xA9	169
ON	OFF	ON	OFF	ON	OFF	ON	OFF	1010 1010	0xAA	170
ON	OFF	ON	OFF	ON	OFF	ON	ON	1010 1011	0xAB	171
ON	OFF	ON	OFF	ON	ON	OFF	OFF	1010 1100	0xAC	172
ON	OFF	ON	OFF	ON	ON	OFF	ON	1010 1101	0xAD	173
ON	OFF	ON	OFF	ON	ON	ON	OFF	1010 1110	0xAE	174
ON	OFF	ON	OFF	ON	ON	ON	ON	1010 1111	0xAF	175
ON	**OFF**	**ON**	**ON**	**OFF**	**OFF**	**OFF**	**OFF**	**1011 0000**	**0xB0**	**176**
ON	OFF	ON	ON	OFF	OFF	OFF	ON	1011 0001	0xB1	177
ON	OFF	ON	ON	OFF	OFF	ON	OFF	1011 0010	0xB2	178
ON	OFF	ON	ON	OFF	OFF	ON	ON	1011 0011	0xB3	179
ON	OFF	ON	ON	OFF	ON	OFF	OFF	1011 0100	0xB4	180
ON	OFF	ON	ON	OFF	ON	OFF	ON	1011 0101	0xB5	181
ON	OFF	ON	ON	OFF	ON	ON	OFF	1011 0110	0xB6	182
ON	OFF	ON	ON	OFF	ON	ON	ON	1011 0111	0xB7	183
ON	OFF	ON	ON	ON	OFF	OFF	OFF	1011 1000	0xB8	184

SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1	Binary Equivalent	Hex Equivalent	Decimal Value
ON	OFF	ON	ON	ON	OFF	OFF	ON	1011 1001	0xB9	185
ON	OFF	ON	ON	ON	OFF	ON	OFF	1011 1010	0xBA	186
ON	OFF	ON	ON	ON	OFF	ON	ON	1011 1011	0xBB	187
ON	OFF	ON	ON	ON	ON	OFF	OFF	1011 1100	0xBC	188
ON	OFF	ON	ON	ON	ON	OFF	ON	1011 1101	0xBD	189
ON	OFF	ON	ON	ON	ON	ON	OFF	1011 1110	0xBE	190
ON	OFF	ON	ON	ON	ON	ON	ON	1011 1111	0xBF	191
ON	ON	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**1100 0000**	**0xC0**	**192**
ON	ON	OFF	OFF	OFF	OFF	OFF	ON	1100 0001	0xC1	193
ON	ON	OFF	OFF	OFF	OFF	ON	OFF	1100 0010	0xC2	194
ON	ON	OFF	OFF	OFF	OFF	ON	ON	1100 0011	0xC3	195
ON	ON	OFF	OFF	OFF	ON	OFF	OFF	1100 0100	0xC4	196
ON	ON	OFF	OFF	OFF	ON	OFF	ON	1100 0101	0xC5	197
ON	ON	OFF	OFF	OFF	ON	ON	OFF	1100 0110	0xC6	198
ON	ON	OFF	OFF	OFF	ON	ON	ON	1100 0111	0xC7	199
ON	ON	OFF	OFF	ON	OFF	OFF	OFF	1100 1000	0xC8	200
ON	ON	OFF	OFF	ON	OFF	OFF	ON	1100 1001	0xC9	201
ON	ON	OFF	OFF	ON	OFF	ON	OFF	1100 1010	0xCA	202
ON	ON	OFF	OFF	ON	OFF	ON	ON	1100 1011	0xCB	203
ON	ON	OFF	OFF	ON	ON	OFF	OFF	1100 1100	0xCC	204
ON	ON	OFF	OFF	ON	ON	OFF	ON	1100 1101	0xCD	205
ON	ON	OFF	OFF	ON	ON	ON	OFF	1100 1110	0xCE	206
ON	ON	OFF	OFF	ON	ON	ON	ON	1100 1111	0xCF	207
ON	ON	**OFF**	ON	**OFF**	**OFF**	**OFF**	**OFF**	**1101 0000**	**0xD0**	**208**
ON	ON	OFF	ON	OFF	OFF	OFF	ON	1101 0001	0xD1	209
ON	ON	OFF	ON	OFF	OFF	ON	OFF	1101 0010	0xD2	210
ON	ON	OFF	ON	OFF	OFF	ON	ON	1101 0011	0xD3	211
ON	ON	OFF	ON	OFF	ON	OFF	OFF	1101 0100	0xD4	212
ON	ON	OFF	ON	OFF	ON	OFF	ON	1101 0101	0xD5	213
ON	ON	OFF	ON	OFF	ON	ON	OFF	1101 0110	0xD6	214
ON	ON	OFF	ON	OFF	ON	ON	ON	1101 0111	0xD7	215
ON	ON	OFF	ON	ON	OFF	OFF	OFF	1101 1000	0xD8	216
ON	ON	OFF	ON	ON	OFF	OFF	ON	1101 1001	0xD9	217
ON	ON	OFF	ON	ON	OFF	ON	OFF	1101 1010	0xDA	218
ON	ON	OFF	ON	ON	OFF	ON	ON	1101 1011	0xDB	219
ON	ON	OFF	ON	ON	ON	OFF	OFF	1101 1100	0xDC	220
ON	ON	OFF	ON	ON	ON	OFF	ON	1101 1101	0xDD	221
ON	ON	OFF	ON	ON	ON	ON	OFF	1101 1110	0xDE	222
ON	ON	OFF	ON	ON	ON	ON	ON	1101 1111	0xDF	223
ON	ON	ON	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**1110 0000**	**0xE0**	**224**
ON	ON	ON	OFF	OFF	OFF	OFF	ON	1110 0001	0xE1	225
ON	ON	ON	OFF	OFF	OFF	ON	OFF	1110 0010	0xE2	226
ON	ON	ON	OFF	OFF	OFF	ON	ON	1110 0011	0xE3	227
ON	ON	ON	OFF	OFF	ON	OFF	OFF	1110 0100	0xE4	228
ON	ON	ON	OFF	OFF	ON	OFF	ON	1110 0101	0xE5	229
ON	ON	ON	OFF	OFF	ON	ON	OFF	1110 0110	0xE6	230
ON	ON	ON	OFF	OFF	ON	ON	ON	1110 0111	0xE7	231
ON	ON	ON	OFF	ON	OFF	OFF	OFF	1110 1000	0xE8	232

SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1	Binary Equivalent	Hex Equivalent	Decimal Value
ON	ON	ON	OFF	ON	OFF	OFF	ON	1110 1001	0xE9	233
ON	ON	ON	OFF	ON	OFF	ON	OFF	1110 1010	0xEA	234
ON	ON	ON	OFF	ON	OFF	ON	ON	1110 1011	0xEB	235
ON	ON	ON	OFF	ON	ON	OFF	OFF	1110 1100	0xEC	236
ON	ON	ON	OFF	ON	ON	OFF	ON	1110 1101	0xED	237
ON	ON	ON	OFF	ON	ON	ON	OFF	1110 1110	0xEE	238
ON	ON	ON	OFF	ON	ON	ON	ON	1110 1111	0xEF	239
ON	ON	ON	ON	**OFF**	**OFF**	**OFF**	**OFF**	**1111 0000**	**0xF0**	**240**
ON	ON	ON	ON	OFF	OFF	OFF	ON	1111 0001	0xF1	241
ON	ON	ON	ON	OFF	OFF	ON	OFF	1111 0010	0xF2	242
ON	ON	ON	ON	OFF	OFF	ON	ON	1111 0011	0xF3	243
ON	ON	ON	ON	OFF	ON	OFF	OFF	1111 0100	0xF4	244
ON	ON	ON	ON	OFF	ON	OFF	ON	1111 0101	0xF5	245
ON	ON	ON	ON	OFF	ON	ON	OFF	1111 0110	0xF6	246
ON	ON	ON	ON	OFF	ON	ON	ON	1111 0111	0xF7	247
ON	ON	ON	ON	ON	OFF	OFF	OFF	1111 1000	0xF8	248
ON	ON	ON	ON	ON	OFF	OFF	ON	1111 1001	0xF9	249
ON	ON	ON	ON	ON	OFF	ON	OFF	1111 1010	0xFA	250
ON	ON	ON	ON	ON	OFF	ON	ON	1111 1011	0xFB	251
ON	ON	ON	ON	ON	ON	OFF	OFF	1111 1100	0xFC	252
ON	ON	ON	ON	ON	ON	OFF	ON	1111 1101	0xFD	253
ON	ON	ON	ON	ON	ON	ON	OFF	1111 1110	0xFE	254
ON	ON	ON	ON	ON	ON	ON	ON	1111 1111	0xFF	255

IRIG Unit Setup

Time Code Output IRIG-B120 200-04 W/ IEEE1344

IRIG-B-120 IS DEFINED IN IRIG STANDARD 200-04 AS:

Format B 100 pps
1 = Sine wave amplitude modulated
2 = 1kHz carrier/1mSec resolution
0 = BCDTOY,CF,SBS

IEEE1344 as Defined in IEEE Std C37.118 TM-2005, Annex F:

IRIG-B format, <sync>SS:MM:HH:DDD<control bits> <binary seconds>

Where:

<sync> is the on time marker
SS seconds 00-59 (60 during leap seconds)
MM minutes 00-59
HH hour of day 00-23
DDD day of year 001-366
<control> 27 binary control characters
<binary seconds> binary seconds of day