SYSTEM HARDWARE DESIGN & INSTALLATION GUIDE
INTEGRITI and INCEPTION SYSTEMS

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- Inner Range recommends that Installers complete relevant Inner Range Training courses. https://www.innerrange.com/Installers/How-to-Become-Certified

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1. INTRODUCTION

1.1 Overview

This document provides general system installation guidelines for Inner Range Integriti and Inception systems. It must be read in conjunction with the Inner Range and 3rd Party equipment installation manuals, the system specification, and any documents relating to relevant regulations and standards that apply to installations performed in your region.

1.2 Additional Documentation

This manual is to be used in conjunction with the Inner Range & 3rd Party Installation Manuals associated with each of the products utilized and any documentation relating to system specifications, standards or regulations that must be met.

The Integriti Integrator Catalogue provides a wealth of information to assist with system planning and design including comprehensive product details, specifications, configuration options & compatibility guides. System deployment & application examples and recommendations are also provided along with a categorized product index.

Where any specifications, requirements, or information in any standard or regulatory requirement differs from information in this manual, the standard or regulatory document takes precedence.

1.3 Risk Assessment.

Prior to any installation a risk assessment should be performed in accordance with local standards or regulations.

When designing the system, select the number and type of detection devices that will be appropriate to mitigate the agreed risk profile selected. This will determine the locations, types and numbers of Expansion Modules required in the system.

1.4 Disarming and Arming procedures

Inner Range systems offer a range of options that allow the arming & disarming procedures to be configured to provide an appropriate level of protection.
A minimum PIN Code length should be specified and options for dual Credential (e.g. Card + PIN) can be employed system-wide or for specific Doors/Areas. Integriti systems also offer a dual User option for high-security Areas.
When selecting a minimum PIN Code length, choose a number appropriate to the number of PINs in use and the level of security required. At least 5 digits is recommended.

The settings for maximum PIN attempts and keypad lockout time should also be set to appropriate values.

The options available for the Area Disarming and Arming procedures must be explained clearly to the client.
Once determined, the agreed arming and disarming methods must be recorded and provided to the client.

1.5 Glossary

Control Equipment	Controller (Inception.ISC/IAC), RS485 LAN Modules, UniBus expansion boards, Power Supply equipment and interface devices.
Credential Reader	Device that reads Cards, Fobs or other credentials such as biometric or mobile device data to identify a User.
IAC	Integriti Access Controller
ISC	Integriti Security Controller
User Terminal	Keypad with alpha-numeric display. e.g. Elite, EliteX, Prisma or PrismaX Terminal

2. SYSTEM DESIGN

2.1 Equipment location

a) General

Install the control equipment and associated equipment such as alarm transmission equipment, indoors, within the alarmed area, and where practicable, where it is not visible from outside the alarmed area. i.e. Within the area monitored and protected by the system.

Install the equipment in a location that meets the environmental conditions specified in the relevant installation manual & any relevant standards or regulations. Typically 0º to 49º Celsius (32º to 120º F) and 15% to 85% Relative humidity (non-condensing).

If mounting an equipment enclosure on a wall, do not mount on the inside of an external wall.
If this is unavoidable, appropriate detection devices such as vibration sensors should be installed within the enclosure to detect any attempt to access the equipment from outside the building.

In addition to the standard range of wall-mounting equipment enclosures, Inner Range also manufactures the following alternatives:

- High security key-locking enclosures.
- 2RU Rack Draw Enclosures for installation in standard 19" Equipment Racks (P/N: 995220)
- A DIN-rail Clip Pack (P/N: 999028) that can be used to mount the Inception Controller, T4000 Communicator or any Integriti Size "B" & "C" PCB's in a DIN-rail cabinet.

b) User Terminals & Credential Readers

e.g. EliteX/Elite LCD Terminals, PrismaX/Prisma Terminals, SIFER Readers, SIFER Keypads & 3rd Party Credential Readers.

System programming & commissioning is generally performed via the Management Software or Browser, however, it is recommended to include at least one EliteX LCD Terminal in the system. In an Integriti system this can provide redundancy and on-site access to the various test & commissioning tools available in the Terminal menu. In an Inception system it can be used to configure network settings if necessary and check Area status.

Inner Range User Terminals are intended for indoor use only unless installed in a suitable weatherproof housing.

Credential Readers should be installed in appropriate locations in accordance with their IP rating and environmental specifications.

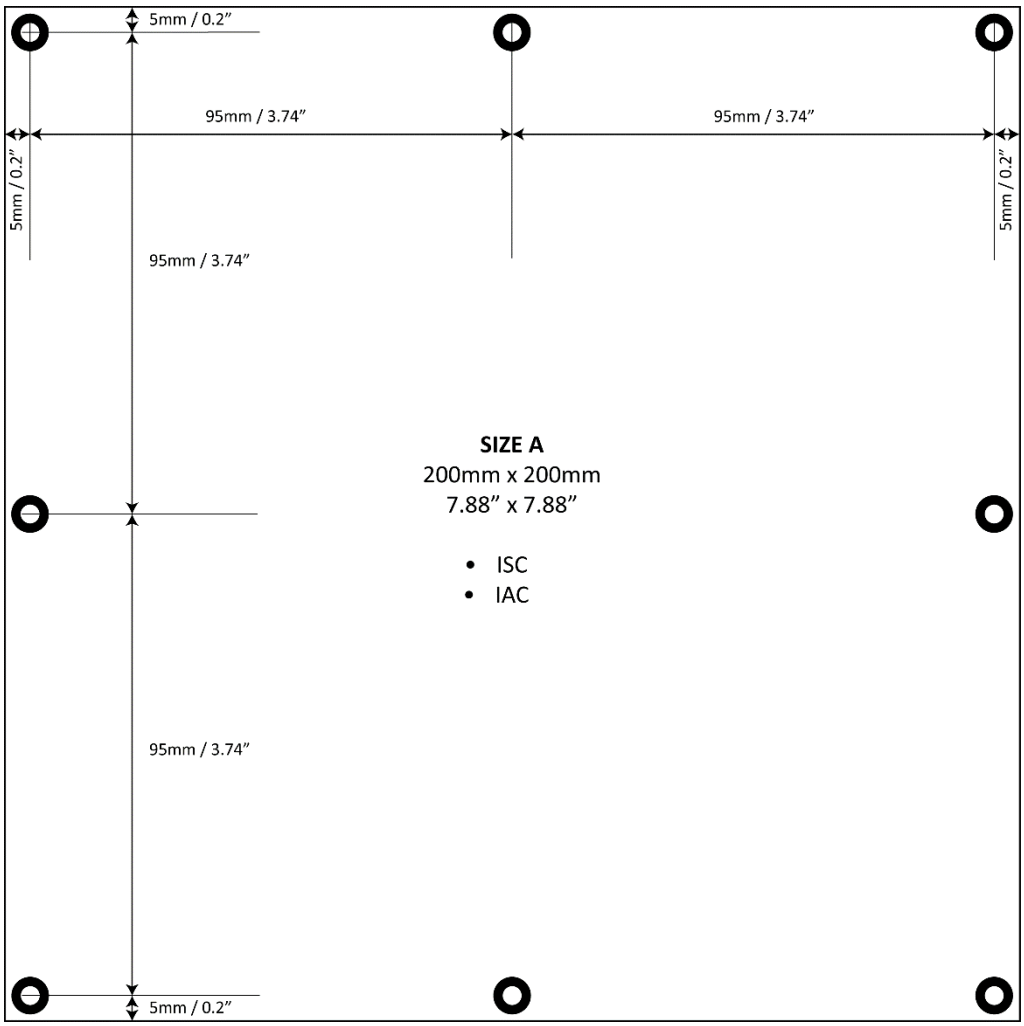
- SIFER & SIFER-Keypad Readers may be installed outdoors.
  Both have an IP67 rating and an operating temperature range of -35°C to +65°C (-31°F to +149°F).
  Where practical, avoid direct sunlight as this may cause the housing colour to fade over time.
- For 3rd Party Credential Reader products refer to the manufacturer's datasheet or installation instructions for IP ratings and environmental specifications.

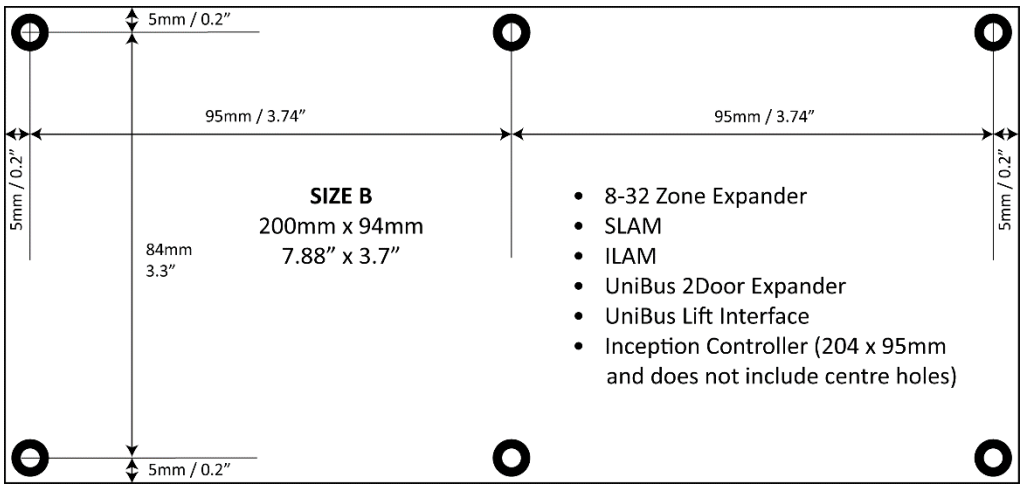
c) Enclosure PCB Layouts

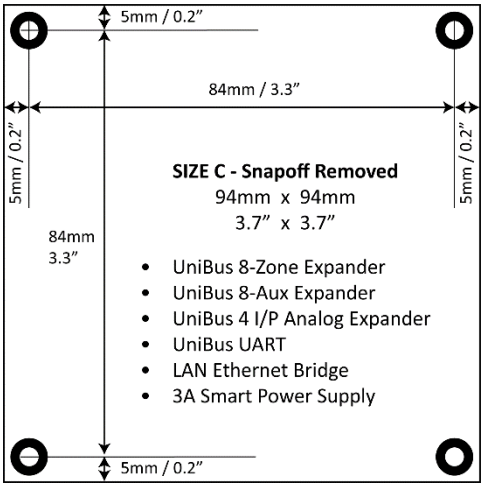
Inner Range enclosures are designed to be versatile and accommodate a variety of products in practical layouts.
PCB Assemblies used in Integriti, Inception & Infiniti systems are manufactured in a small number of standard sizes to simplify physical system design.
Typical layout options are illustrated in the Integriti Integrator Catalogue under each product in the 'Enclosures' section.

The following drawings show dimensions for each of the PCB sizes and the products associated with each. The drawings are reduced to 67% of the actual size. Full size images can be obtained from the Technician Downloads portal on the website.

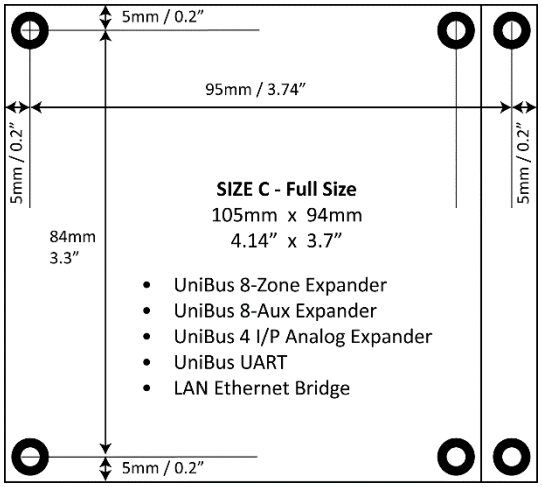
NOTE: Most Size C products are supplied with a small snap-off section on one edge. This can normally be removed for mounting on the Size C footprints provided in Inner Range enclosure bases & mounting plates.
The snap-off section must be retained in cases where a Size C board must be mounted above a Size B board. If required, this is done using 35mm Hex Brass Standoffs purchased separately (Part Number for pack of 10: 999009)

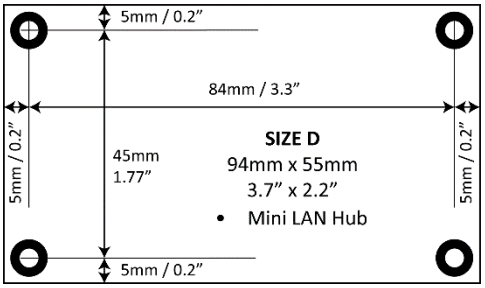

5mm / 0.2”
95mm / 3.74”
95mm / 3.74”
5mm / 0.2”
5mm / 0.2”
95mm / 3.74”
SIZE A
200mm x 200mm
7.88” x 7.88”
• ISC
• IAC
95mm / 3.74”
5mm / 0.2”


5mm / 0.2”
95mm / 3.74”
95mm / 3.74”
5mm / 0.2”
5mm / 0.2”
84mm
3.3”
SIZE B
200mm x 94mm
7.88” x 3.7”
• 8-32 Zone Expander
• SLAM
• ILAM
• UniBus 2Door Expander
• UniBus Lift Interface
• Inception Controller (204 x 95mm and does not include centre holes)
5mm / 0.2”



See note on p3 for additional information on Size C boards.





2.2 Power Supplies

a) Mains power.

Mains power should be sourced from a permanent external mains power supply. Check the system specification and local regulations to determine whether the mains supply to each device is required to be unswitched, switched or fixed wiring.

b) Choosing a Power Supply.

Integriti LAN Modules and the IAC are designed to be powered using Integriti DC power supplies via the module's on-board 10way External PSU Connection. Powering each Integriti LAN Module with a dedicated Integriti Power supply of an appropriate rating is highly recommended.

When choosing a power supply for an IAC, LAN Module or other product, the current required by any of the following relevant devices must be taken into account when calculating the total load current:

1. The Controller or Module itself.
2. The Battery. Sufficient current must be reserved to recharge the Battery within the required recharge time.
3. An Alarm Communicator connected to a Controller.
4. UniBus Boards connected to the Controller or Module.
5. Other Modules powered from the same supply. e.g. Another LAN Module or Ethernet Bridge in the same enclosure or any User Terminals or remote Modules being powered from the same power supply via the LAN connection.
6. Credential Readers. (Card Readers, Biometric Readers, etc.)
7. Powered Detection Devices. (PIRs, Glassbreak detectors, PE Beams, Smoke Detectors, etc.)
8. Warning devices. (Sirens, Screamers, Strobes, Indicator Lamps, etc.)
9. Locks powered from the same power supply. (Depending on the number & types of locks, and/or battery backup time required, a separate battery-backed supply may be required for lock power)
10. Any other peripheral devices being powered via the supply outputs on the Controller/Module or the power supply.

Integriti Security Controllers (ISC) and Inception Controllers have on-board power supplies. Note the power supply current limits specified in the Installation Manuals.

The current required by each Inner Range product is provided in each product's installation manual and in the product catalogue to assist the installer in calculating the current required for each equipment configuration.
For 3rd party equipment such as detection devices, sounders, readers, locks, etc., the installer will need to consult the manufacturer's product documentation.

Inner Range Power Supplies. Availability may vary by region.

P/N	DESCRIPTION	MAXIMUM BATTERY CHARGING CURRENT
996090PCB&K	2A Standard Power Supply	Remaining current after the load current is subtracted from the total current. At least 700mA should be allowed for Battery charging, which would limit the maximum continuous load current to 1.3A (2A PS) or 2.3A (3A PS).
996091PCB&K	3A Smart Power Supply	
996092	8A Smart Power Supply	2.0A if all other loads are less than 6.0A.
996095	10A PFC (Power Factor Corrected) Smart Power Supply	2.5A if all other loads are less than 7.5A.

Inner Range Smart PSU Bus Connection.
Integriti Access Controllers (IAC), LAN Expander Modules, Access Control Modules and Ethernet Bridges should be powered by Battery-backed Inner Range Smart Power Supplies using the 10-way Bus Cable supplied with the Power Supply. This allows a wide range of Power Supply conditions to be monitored and dynamic Battery testing to be configured easily.

If an additional Module that supports the Bus connection must be installed in the same enclosure, it may be powered via the Ancillary/3rd Party PSU Cable (P/N: 996794). This cable has a pair of flying leads that connect to a general-purpose output on the Power Supply and a 10-way socket that connects to the Power Supply Bus connection on the Module.
e.g. An Ethernet Bridge installed in an 8-Zone LAN Expander enclosure, or an 8-Zone LAN Expander installed in a SLAM enclosure, etc.

CAUTION:

1) When a Module is powered via the Ancillary/3rd Party PSU Cable or utilizes the External PSU Bypass Link, Module power, DET+ and LAN+ are combined. A short-circuit or fault on any of these may also bring down the other supplies. e.g. A short circuit on the +/- wires of a powered Detector cable or Reader cable may cause loss of power on the LAN Module and all associated devices such as lock relays and warning devices. Use of the Ancillary/3rd Party PSU Cable or the Bypass Link is therefore not recommended on an IAC, ILAM or SLAM and suitability for use on other Modules should be assessed according to your application.

2) Ensure that the Power Supply & Battery have adequate capacity to power & backup <u>both</u> Modules.

User Terminals and System Peripherals.
User Terminals are typically powered via the LAN connection, with the source usually being the nearest powered LAN Module. The current consumption of each Terminal must be considered when calculating the total current required from that Power Supply. Terminals may also be powered by a local Battery-Backed Power Supply if necessary. e.g. Standard 2A PS.

Other system devices such as Credential Readers, Detectors and Warning Devices must also be powered by battery-backed power supplies. Dedicated power supply outputs are provided for many of these devices on the Controllers and Host Modules. e.g. LAN+, DET+, RDR+, etc.
Where a power supply source on the Controller or Host Module is not available or inadequate, the general-purpose outputs on Inner Range Smart or Standard Power Supplies are recommended. Depending on load and Battery backup time requirements, additional Power Supplies may be required.

Locks.
IACs, Access Control Modules (SLAM & ILAM) and UniBus Door Expanders have a Lock Power Input that must be connected directly to a current-limited, Battery-backed Power Supply. This may be the Power Supply that is powering the Module, or a separate Power Supply, depending on the Lock power and Battery backup time requirements. *Refer to the relevant Installation Manual for recommendations.*

Power Supply Status Monitoring and Battery Testing.
BUS CONNECTION: Any Smart Power Supply connected to an IAC or LAN Module via the 10-Way Bus, can be monitored and have Battery testing controlled via the Host Module. No other connection is necessary.

NO BUS CONNECTION: The Standard 2A Power Supply, or any Smart Power Supply that cannot be connected to a LAN Module via the 10-way Bus, must be monitored and controlled via low-level connections.

- AC Fail & Low Battery outputs are wired to Zone Inputs on a nearby Module. *Refer to the Power Supply Installation Manual for details.*
- The Battery Test Input can be controlled by an Auxiliary output on a nearby Module. *Refer to the document "Integriti_Application_Note-Battery_Testing_On_2A_PSU.pdf"*

NOTE: Ideally, any enclosure containing a Smart Power Supply should have a LAN Module that supports the 10-way Bus connection present in the same enclosure and be connected to the Module via the Bus connection.

LAN Power.
If necessary, a remote LAN Module with modest power requirements and no local Power Supply may be powered from the LAN. The incoming LAN cable must be of an appropriate wire gauge and must have adequate power capacity from a nearby Battery-backed power source. e.g. Another LAN Module powered by a 3A or 8A Smart Power Supply. All 4 LAN wires are connected to the LAN port on the Module and the Integriti External PSU Bypass Link (P/N: 996793) must be fitted to the 10-way PS Bus connector.
CAUTION:

1) When a Module utilizes the External PSU Bypass Link or the Ancillary/3rd Party PSU Cable, Module power, DET+ and LAN+ are combined. A short-circuit or fault on any of these may also bring down the other supplies. e.g. A short circuit on the +/- wires of a Detector cable or Reader cable may cause loss of power on the LAN Module and all associated devices such as lock relays and warning devices. Use of the Bypass Link or the Ancillary/3rd Party PSU Cable is therefore not recommended on an IAC, ILAM or SLAM and suitability for use on other Modules should be assessed according to your application.

2) LAN Power must not be used if one or more UniBus Boards are connected.

3rd Party Power Supplies or legacy Concept 2A Power Supplies.
Suitable, compliant, Battery-backed 3rd Party Power Supplies or legacy Concept power supplies may be used in the system. However, they should not be used for Modules that have one or more UniBus boards connected.

If powering a LAN Module, the Ancillary/3rd Party PSU Cable (P/N: 996794) should be used OR the power supply connected to the LAN+/LAN- terminals and the External PSU Bypass Link (P/N: 996793) fitted to the 10-way PS Bus connector. Low-level status monitoring will need to be employed to connect status outputs to Zone Inputs. Refer to the PSU manufacturer's installation instructions and the Inner Range Module Installation Manual.
NOTE: CAUTIONARY NOTE 1 ABOVE ALSO APPLIES TO THIS METHOD OF POWERING A MODULE.

c) Batteries

Choose appropriate 12V Valve-regulated, SLA (Sealed Lead Acid) or AGM (Absorbed Glass Matt) Batteries for every Power Supply. Batteries with a charge rate specification of 0.25C or better are recommended. (i.e. Charge current can be up to 25% of the Battery AH Capacity). Non-rechargeable batteries must not be used.

In the system design, the load on each Power Supply and the Battery capacity must be selected such that:

1) Under failure of the external mains supply, the system, including the alarm transmission equipment, will continue to operate for the required Battery backup time.
2) The battery will recharge sufficiently to achieve the backup capacity required above, within the required Battery recharge time after the external mains supply is restored. Note that the current available for Battery charging MUST NOT exceed the Battery's charge rate specification.

Calculating Battery Backup Time.
An estimate of Battery backup time can be made by using the formula:
Battery Capacity (AH) x 0.85 / Average Total Current Draw (A) = Backup Time
e.g. For 1.5A Average Total current from a 7AH Battery. 7 x 0.85 / 1.5 = 4 Hours.
For 1.9A Average Total current from an 18AH Battery. 18 x 0.85 / 1.9 = 8 Hours.

Calculating Battery Re-charge Time.
An estimate of Battery re-charge time can be made by using the formula:
Battery Capacity (AH) x 1.25 / Charge Current Available (A) = Recharge Time
e.g. If 700mA is available to charge a 7AH Battery. (0.1C) 7 x 1.25 / 0.7 = 12.5 Hours.
If 2A is available to charge an 18AH Battery. (0.11C) 18 x 1.25 / 2 = 11.25 Hours.
NOTE: The maximum charge current available from each Power Supply is listed under "Inner Range Power Supplies" above.

The required Battery backup time and recharge time should be provided in the system specification &/or the regulations and standards that apply to the installation &/or as agreed between the Installer and the Client.
If a power supply load or Battery capacity is such that these requirements cannot be met, then the system design will require one or more additional battery-backed power supplies to distribute the load.

Install the battery in each enclosure as per the relevant installation manual.
Mark every battery with the month and year of installation and keep a record. Ensure that the marking is legible and durable.
Battery installation date and lifetime values can be entered for each Module in the management software.

2.3 Wiring

a) General

All wiring described in this document must meet the requirements stated in the relevant installation manuals and any relevant local regulations and standards.

Wiring must be arranged to minimize the risk of attack or damage and should be concealed.

Wiring and all associated materials must be chosen to suit the expected environmental conditions at the installed location.

Note that third party wire and cable recommendations provided in the individual installation manuals for Inner Range products and the two tables provided in this section are intended as a guide only. **Check that any wire & cable used meets local regulations & standards.**

b) Wire Rating

i) General.

Wire rating and size must be chosen according to the intended wire length and load such that when running on backup battery power (12V), at the maximum expected current, the voltage drop in the wiring will not reduce the terminal voltage at any device to less than the minimum operating voltage of the device.
e.g. If a device's minimum operating voltage is 11 VDC, then at the maximum expected current, the voltage drop in the wiring must be less than 1 VDC. *See 'Cabling Distance' below for more details.*

ii) Minimum ratings

All wiring should meet the following minimum ratings:
- A total cross-sectional area of at least 0.20mm^2 (24 AWG).
- An outer sheath insulation rating of at least 300V RMS.

c) Cable Types

The following two tables list the types of cables commonly used in Inner Range system installations.
The applications listed in **Bold Type** are the recommended applications for that cable type.

TWISTED PAIR

Type	Description	Examples	Application
Shielded, Twin Twisted-pair.	Two twisted pairs of multi-strand wire with overall or individual shielding.	Alpha 2466C or 6413 Belden 8723 or 9842 Electra EAS7202P or EAS16202P Garland MCP-2IS or MCP-2S Tycab DQQ47025 or DPF4702 X2-CABLE-810 or 811 or 812	**RS485 LAN.** **SIFER / OSDP Readers.** **Infiniti ELM.**
Unshielded, Twin Twisted-pair.	Two twisted pairs of multi-strand wire.	Alpha 1317C Belden 9744	* RS485 LAN. * SIFER / OSDP Readers. * Infiniti ELM. **** See Note 1 below.***
4-pair Unshielded Twisted Pair (UTP) ***See Note 6 below.***	Ethernet Cable: Category 5e Category 6	 Alpha 76000 / 74009 Belden 1583A / 1583E Alpha 74010 Belden 2412 / 7965E	**Ethernet connections.** * RS485 LAN. * SIFER / OSDP Readers. * Infiniti ELM. **** See Note 1 below.*** ^ Credential Readers with Wiegand Data O/P. ***^ See Notes 2, 3 & 4 below.***

NOTES

1 May be used if system specifications & regulations permit but may have additional limitations. *See relevant installation manual for guidance.*

2 NOT recommended but may be used if system specifications & regulations permit. e,g. If the cables are already present in an existing installation & replacement is not viable. Additional limitations will apply, and on-site testing may be required to determine suitability. *Contact Inner Range Technical Support for advice.*

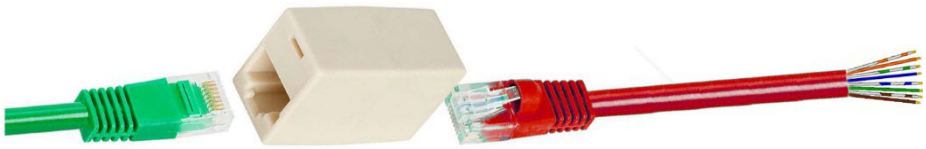
3 If Twisted-Pair cable is used for Wiegand connections, the serial data wires MUST NOT be in the same pair.

4 Wiegand connections may require up to 7 core cable depending on LED & Beeper operation requirements. (e.g. +, -, D0, D1, Red LED, Green LED & Beeper)

5 Inner Range manufactures a range of pre-assembled cables for these applications.

6 UTP Ethernet Cable. Exercise care and use appropriate methods to terminate UTP cable, as the wire cores are single strand (solid core) and not intended to be used in screw-terminals.
When joining stranded wire to solid core wire, use joiners or jointing methods that are compatible with both wire types. If the UTP cable is terminated with an RJ45 plug, an adapter, such as the one pictured below left, may be used to make the connections to the host Module terminals using one of the recommended stranded cable types. Alternatively, an RJ45-RJ45 Ethernet Cable Joiner may be used along with a short length of Stranded Ethernet Patch Cable to make the connections to the host Module as shown below right.

RJ45 to screw terminal adapter.



UTP cable from Reader

Stranded UTP Patch cable to host Module

NON TWISTED PAIR

Type	Description	Examples	Application
Shielded Multi-core Data Cable.	4 to 8 Cores of multi-strand wire with overall shield. NON twisted-pair.	7 or 8-CORE: Alpha M39028 or 6300/8 Belden 9537 or 9538 Tycab DMC8702 X2-CABLE-805, 806 or 807 6-CORE: Alpha M39027 Belden 9536 4-CORE: Alpha 6300/4 Belden 9534	**^ Credential Readers with Wiegand Data O/P.** ***^ See Note 4 below.*** **† RS-232 Data Connections.** - **Printer** - **PC** - **External modem.** ***† See Note 5 below.*** * RS485 LAN. * SIFER / OSDP Readers. * Infiniti ELM. **** See Note 2 below.***
Unshielded Multi-core.	4 or 6 Core multi-strand cable. i.e. 'Security' or 'Alarm' Cable.	6-CORE: Alpha 1176C or M13306 Belden 5504UE Tycab SEC6142 X2-CABLE-400 or 450 4-CORE: Alpha 1174C or M13404 Belden 5302UE, 5402UE, 5502UE Tycab SEC4142 X2-CABLE-200 or 250	**Powered Detectors.** **PIR, PE Beam, Glass-break, etc.** **Low-current Warning Devices if tamper monitoring also required.** **Strobe, Piezo Screamer, Beeper, etc.** ^ Credential Readers with Wiegand Data O/P. ***^ See Notes 2 & 4 below.*** * RS485 LAN. * SIFER / OSDP Readers. * Infiniti ELM. **** See Note 2 below.***
Figure 8.	Twin core multi-strand cable. Choose wire gauge according to load and cabling distance.	Belden 8649 or 9708 Tycab LFC21402 or LFC22402 X2-CABLE-001, 002, 050 or 051	**Unpowered Detectors.** **Tamper switch, Reed-switch, Exit button, Arm button, etc.** **Siren Speakers connected to Integriti Siren outputs.** **Low-current Warning Devices if tamper monitoring NOT required.** **Strobe, Piezo Screamer, Beeper, etc.** **Locks.** Note that an additional multi-core cable may be required for lock monitoring. e.g. Tongue Sense.

NOTES

1 May be used if system specifications & regulations permit but may have additional limitations. *See relevant installation manual for guidance.*

2 NOT recommended but may be used if system specifications & regulations permit. e,g. If the cables are already present in an existing installation & replacement is not viable. Additional limitations will apply, and on-site testing may be required to determine suitability. *Contact Inner Range Technical Support for advice.*

3 If Twisted-Pair cable is used for Wiegand connections, the serial data wires MUST NOT be in the same pair.

4 Wiegand connections may require up to 7 core cable depending on LED & Beeper operation requirements. (e.g. +, -, D0, D1, Red LED, Green LED & Beeper)

5 Inner Range manufactures a range of pre-assembled cables for these applications.

d) Cabling Distance

There are two aspects of cabling distance that must be considered.

1) Data. e.g. RS485, Wiegand, RS232, etc. This is the cabling distance that can be achieved when the cable is only being utilized for the data signals. i.e. A, B & 0V for RS485; D0, D1 & 0V for Wiegand; RX, TX & 0V for RS232, etc. Data cabling distance recommendations are provided in the relevant installation manuals.
2) Power. This is the cabling distance that can be achieved when the cable is also used to power the connected device/s. It is determined by the total current drawn by all devices on the cable run and is often significantly less than the data cabling distance. Installation manuals provide power cabling distance recommendations for the particular product where relevant.
   The following table can be used as a general guide in other cases assuming the device/s on the cable run can operate reliably with a terminal voltage of 11 VDC.

Wire Gauge (AWG):	**24**	**22**	**21**	**20**	**18**	**16**
Stranding Examples (metric) *:	7/0.20mm 1/0.51mm	7/0.25mm	14/0.20mm 7/0.30mm	24/0.20mm 8/0.30	19/0.25mm 14/0.30	30/0.25mm 19/0.30
Loop Resistance: Ohm/m **Ohms/ft**	0.168 0.0514	0.106 0.0323	0.084 0.0256	0.0665 0.0203	0.042 0.0128	0.0263 0.008
Total Current on the Cable run.	**Max. Cable Length (metres) ^**					
10mA e.g. Infiniti ELM + Reed Switch	600	950	#			
15mA e.g. Paradox DG55/65 PIR	400	630	800	1000	1600	
35mA e.g. Takex PA04810 Quad PIR	170	270	340	425	680	1060
50mA e.g. EliteX Terminal †	120	190	240	300	480	750
75mA e.g. SIFER Reader ‡ OR Paradox RF Expander	80	125	160	200	320	500
100mA e.g. Paradox NVX80 Detector	60	95	120	150	240	375
150mA e.g. SIFER Reader † OR Inovonics RF Expander	40	62	80	100	160	250
200mA e.g. EliteX-SIFER Term. † OR Typical Lock Strike.	30	47	60	75	120	187
300mA e.g. PrismaX-SIFER Term. †	20	31	40	50	80	125
500mA e.g. Typical Magnetic Lock	12	19	24	30	48	75
1A e.g. 8 Ohm Siren Speaker	6	9	12	15	24	37

NOTES:
* Stranding is No. Of Strands / Strand diameter.
\# Exceeds data cabling distance for the specific example given.
† Brightness/Volume settings at maximum.
‡ Factory default settings.
^ Cable length in Feet = Length in metres x 3.281

This online voltage-drop calculator may be useful.
https://www.rapidtables.com/calc/wire/voltage-drop-calculator.html#calculator

Spare pairs in a multi-core cable can be connected in parallel with the power supply wires to increase the power cabling distance.
e.g. If only 4 connections are required in a 6-core 24 AWG cable, the 2 spare wires can be connected in parallel with the red and black wires. In this example, the power connection would then be 21 AWG.

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e) Terminations

All wiring connecting to Integriti/Inception equipment must be terminated using the relevant method from the following list:

- The cable provided with the product. e.g. UniBus patch cable, Smart PSU cable, Inner Range Battery Cable, etc. NOTE: A 270mm UniBus cable is supplied with every UniBus product. Other lengths from 150mm to 675mm can be purchased separately.
- The pre-assembled cable recommended by the manufacturer. e.g. T4000 Interface cable, Port0 Interface Cable, Computer interface cable, etc.
- The plug-on screw terminal connectors provided in the installation kit. e.g. Zone Inputs, Relay outputs, RS485 LAN, Reader, Siren, etc.
- The screw terminal connectors on the product. e.g. EliteX & PrismaX Terminals.

Connector Description	Wire Size Range		Where Used
	CSA* (mm^2)	AWG	
Green 5mm Keyed Plug-In Screw Terminal. 2, 3, 4 & 6-Way. Stripping length: 6mm	3.0 max.	22 to 12	Inception Controller Inputs & Outputs. 10A PFC Smart Power Supply 'BATT' (T5)
Green 5mm Keyed Plug-In Screw Terminal. 6-Way. Stripping length: 7mm	3.0 max.	28 to 12	8A Smart Power Supply 'V+/V-' (T3) 10A PFC Smart Power Supply 'V+/V-' (T3)
Blue 5mm Plug-On Screw Terminal. 2, 3, 4, 6 & 8-Way Stripping length: 6mm	2.5 max.	24 to 14	PCB AC Input. PCB Zone Inputs. PCB DET+/DET- Outputs. PCB Tamper Switch Inputs. PCB RS485 & Reader Ports. PCB Door Inputs & Outputs. PCB Lock Inputs & Outputs. PCB Siren & Auxiliary Outputs. PCB Power Inputs & Outputs 2A & 3A Power Supply Inputs & Outputs.
Green 3.5mm Keyed Plug-In Screw Terminal. 2, 3, 4 & 5-Way. Stripping length: 7mm	0.1 to 1.5	28 to 16	8A Smart Power Supply T4 10A PFC Smart Power Supply T4 T4000 Inputs & Outputs. OSDP-Wiegand Converter Inputs & Outputs.
8-Way PCB Mount Screw Terminal. Stripping length: 5 - 6mm	0.14 to 2.0	26 to 14	Elite LCD Terminal. EliteX LCD Terminal.
4-Way PCB Mount Screw Terminal. Stripping length: 5 - 6mm	0.14 to 2.0	26 to 14	Prisma Terminal. PrismaX Terminal.

If any RS485 LAN, Reader RS485, or DET+/0V terminals are inadequate for the number of wires to be connected, or if you wish to have separate plug-on connectors for separate runs of RS485 cable, a range of LAN and Power Hub Boards are available as follows:

P/N	Description	Details
995910	Multi-purpose Hub	9x 4-way LAN connections + 8-way DET+/0V connectors.
995911	LAN Hub (Break-away type).	10x 4-way LAN connections. Three snap-off sections (4 + 3 + 3).
995914	Detector Power.	32x DET+/0V connections.
995915	Mini LAN Hub.	8x 4-way LAN connections.

2.4 Heat Dissipation Of In-cabinet Devices

In some circumstances you may receive requests for details of the heat dissipation of Inner Range equipment. Usually in relation to planning ventilation & air-conditioning system requirements in equipment cabinets or racks, communication or server rooms, etc. in which the equipment may be installed.

As most power consumed by the equipment is dissipated as heat, the safest way to calculate heat dissipation is to add up the maximum on-board power consumption values for each device. The result (Watts) can then be converted to BTU/hr. for the purposes of ventilation and air-conditioning system design.

This table lists the maximum on-board power consumption for the relevant Integriti, Inception & Infiniti products. i.e. With all I/O ports active, on-board relays on, etc. Where relevant, the additional dissipation due to battery charging is also listed. This additional dissipation may persist for some minutes or hours following a power outage, siren operation or battery replacement.

NOTES: 1) For IAC, LAN Modules & UniBus Boards, if a power value other than the maximum is requested, use the appropriate current consumption values provided in the Product Catalogue and multiply by 13.75 for the power consumption in Watts. For all other devices, the value provided in this table should be used.

2) The figure does not include power dissipated by connected devices which are not normally installed in the control equipment enclosure or in the same room. e.g. Detectors, Sensors, Readers, Sirens, Strobes, Locks, User Terminals, etc.

For Inner Range devices not listed here, refer to the current Integriti Product Catalogue. Use the relevant current consumption value provided for that device and multiply by 13.75 for the power/heat dissipation in Watts, for that device.
For 3rd Party devices installed in a control equipment enclosure, refer to the equipment manufacturer's documentation for the maximum current or power consumption specification and use the formula described above.

Module or Device	Part Number	Power/Heat Dissipation.
Integriti Security Controller (ISC)	996001	4.0W Add up to 4.8W during Battery charging.
Integriti/Infiniti Access Controller (IAC)	996035/996040	3.5W
Inception Controller	996300	4.2W Add up to 1.8W during Battery charging.
2A Standard Power Supply	996090PCB&K	4.9W Add up to 2.4W during Battery charging.
3A Smart Power Supply	996091PCB&K	7.3W Add up to 4.8W during Battery charging.
8A Smart Power Supply	996092	15.8W Add up to 6.9W during Battery charging.
10A PFC Smart Power Supply	996091PCB&K	19.5W Add up to 8.6W during Battery charging.
2.5A 24VDC Adapter	999066	6.7W
3A Mains Power Transformer	560007	9.0W
4A Mains Power Transformer	560005	12W
8 Zone LAN Expander Module	996005PCB&K	1.8W
Infiniti Encrypted Expander Module	996105PCB&K	0.7W
Standard LAN Access Module (SLAM)	996012PCB&K	2.9W
Intelligent LAN Access Module (ILAM)	996018PCB&K	2.9W
Inner Range LAN Ethernet Bridge	996088	0.9W
UniBus 2-Port UART	9965	0.7W
UniBus 2-Door Expander	9965	1.9W
UniBus 8-Zone Expander	996500	1.0W
UniBus 8-Relay Expander	9965	2.4W
UniBus 16-Floor Lift Interface	9965	4.3W
UniBus 4 I/P Analogue Expander	9965	3.2W
T4000 Security Communicator. (Standard)	998530	1.8W
T4000 Lite Security Communicator	998530LT	2.0W
T4000 Ultralite Security Communicator.	998536	2.0W
T4000X Security Communicator.	998532	2.0W
Inception 4-Port Mini USB Hub	999032	0.6W
Inception USB Wi-Fi Adapter	999039	0.6W
Inception USB PSTN Modem	999031	1.4W
Inner Range OSDP<>Wiegand Converter	994200	0.5W
LAN Hubs.	995910/995915	0.05W
Inner Range Fibre Modem-S	995087	2.2W
Inner Range Fibre Modem-M	995081	0.5W
Inner Range LAN Isolator	995080PCB&K	1.0W
Inner Range 2x10A Relay Boards	995083M	1.3W
Shock Detector (In Class 5 Enclosures)	n/a	0.3W

Examples:

- ISC with 3A Mains Power Transformer, UniBus 8-Relay Expander and T4000 Security Communicator. Maximum in-cabinet power dissipation will be 4W + 9W + 2.4W + 1.8W = 17.2W (22W during Battery Charging)
- Inception Controller with 2.5A 24VDC Adapter, 8-Zone LAN Expander and T4000 Lite Communicator. Maximum in-cabinet power dissipation will be 4.2W + 6.7W + 1.8W + 2.0W = 14.7W (16.5W during Battery Charging)

3. INSTALLATION

3.1 Installing the control equipment.

a) Mounting the equipment

Fix all enclosures, User Terminals and Credential Readers securely to the mounting surface using corrosion-resistant bolts, screws and washers suitable for the environment, and in a position that minimizes the risk of interference or damage.

Use fixings in all the mounting holes provided in the equipment enclosures and User Terminals.

b) Equipment labelling

Inner Range enclosures and equipment supplied from the factory in an enclosure are supplied with an equipment label affixed to the enclosure cover.

Other products to be installed in an enclosure may also be supplied with an adhesive label in the accessory kit. This label must be affixed to the outside of the equipment enclosure where it will be clearly visible, in addition to any existing label as shown.

c) Tamper detection

i) Tamper Switches.

Fit the supplied Tamper switch to all control equipment enclosures as per the installation instructions and connect to the "TAMP/0V" input on a Controller or LAN Module installed inside the same enclosure.

Tamper detection devices must also be fitted to all audible warning device enclosures. The tamper detection device must be designed to activate prior to, or on opening of the enclosure; and prior to, or on removal of the enclosure from its mounting surface.

If the enclosure does not contain a Controller or LAN Module (e.g. A Siren enclosure, or an enclosure that only contains power supply equipment or an alarm communicator), the Tamper switch must be fitted with EOL Resistors and connected to an Input on a nearby LAN Module. *See "End-of-line Supervision" for details.*

Inner Range User Terminals and SIFER products have a built-in tamper switch/detector.
In products with a tamper switch actuating lever, ensure it is properly fitted as per the installation instructions and that the switch is operational.
EliteX & PrismaX Terminals and SIFER products have a built-in optical tamper sensor. Ensure that no obstruction interferes with the tamper sensor or the sensor window in the terminal backplate and that the sensor is operational.

If 3rd Party Credential Readers are used, choose products that include tamper detection if practicable and follow the manufacturer's instructions to ensure that the tamper condition is monitored.

ii) Early Warning Tamper Detection

In certain situations, an early warning tamper detection device may be recommended to detect any attempt to penetrate the enclosure or remove it from its mounting surface prior to the activation of the tamper switch/es.
e.g. When an equipment enclosure is installed on the inside of an external wall.
In this case a suitable Shock/Vibration Sensor should be installed within the equipment enclosure. Fit EOL Resistors and connect it to a spare Zone Input.

iii) Securing equipment enclosures

Equipment enclosure covers must be fitted and secured with the supplied screws.
Inner Range also manufactures several equipment enclosures with facilities for keyed locks to cater for higher security requirements. *Refer to the current product catalogue for details.*

d) Outputs

Items of control equipment may provide one or more relay outputs, open collector outputs, 13.75V DC outputs or 5V DC outputs for controlling and/or powering peripheral devices such as sirens, alarm sounders, strobes, readers, door locks, indicator lamps, etc.

Do not exceed the current and voltage limits specified for each output.
The limits for each output are specified in the installation manual for the product.

e) Troubleshooting Common Power Supply Issues

DESCRIPTION	REMEDY
UniBus Board not working.	The host Module is not powered via the 10-way PSU bus connector and an External PSU Bypass Link (P/N: 996793) has not been fitted. If UniBus Boards are connected, the Module should be powered by a dedicated Inner Range Smart Power Supply via the 10-way PSU Cable.
Siren outputs not working.	Siren Driver outputs are disabled if the Battery is not connected to the Power Supply.

3.2 Installing the Detection Devices

a) General

Install all detection devices such that their type and location provide an optimized balance between intruder detection and the risk of detecting unwanted signals and interference.
e.g. A PIR must not be installed where movement outside the protected area (i.e. through a window), or sudden changes in temperature may cause a false alarm.
Refer to the detector manufacturer's installation instructions.

It is recommended that only one detection device should be connected or assigned to each Zone Input address.
Note: This may be mandatory depending on the system specification, regulations, or standards to which the system is being installed. If multiple detection devices of the same type are used to monitor a single-entry point such as a double door or multiple windows within the same frame, then those devices may be allowed to be connected or assigned to a single Zone Input address.

b) End-of-line supervision

Detection devices should be installed using dual end-of-line resistors as described in the installation manuals.
Inner Range also manufactures an Encrypted Expander Module and End-of-line Module for use in high-security applications. Contact your supplier or check the website for details.

3.3 Installing the Warning Devices

All warning devices must meet the requirements of local regulations and standards. Check that the installation and programming options (e.g. Siren Time) selected for the devices do not contravene any legislation pertaining to these devices.
Warning device enclosures must have tamper detection devices fitted and connected to the Control Equipment via one of the methods described in the relevant Controller or Module Installation Manual.
Locate all warning devices to minimize the possibility of inadvertent damage or interference.

SIREN SPEAKER CONNECTIONS.

- The Integriti Security Controller (ISC), the 8-Zone LAN Expander Module and the Encrypted Expander Module all provide 2 dedicated Siren speaker outputs ('External' Siren and 'Internal' Siren) designed to drive one or two 8 Ohm, 10 Watt, Horn-style Siren Speakers.
- Each output delivers approximately 7W into an 8 Ohm Siren Speaker or 14W into a 4 Ohm load. i.e. Two 8 Ohm 10W Siren Speakers wired in parallel.

The sensitivity of 8 Ohm Siren Speakers is typically expressed in dB SPL for 1 Watt input at 1 Metre distance. Values typically fall in the range of 95 to 105dB. To estimate the Sound Pressure Level (SPL) generated at 1 metre distance when connected to an Inner Range Siren Output, add 8dB to the Speaker sensitivity specification.

e.g.

Speaker Sensitivity. SPL for 1 Watt @1 Metre.	Siren Speaker Output @ 1 Metre
95dB	103dB
98dB	106dB
102dB	110dB
105dB	113dB

SATELLITE SIREN, PIEZO SIREN and STROBE CONNECTIONS
These devices require 12V DC rather than an audio signal.
They can be controlled by any convenient Auxiliary Relay output that has a suitable 12V supply nearby (VOUT, DET+, Inner Range Power Supply, etc.). e.g:

- 'OUT1' to 'OUT4' on an Inception Controller.
- 'AX1' or 'AX2' on an Integriti Security Controller (ISC) or 8-32 Zone LAN Expander Module.
- Relay outputs on a UniBus 8-Auxiliary Expander Board.
- An unused 'LOCK' or 'DOTL' Relay on an Integriti Access Controller (IAC). (If the Relay is not associated with a Door)

If a strobe light is required install it outside, or where it will be clearly visible from outside the premises and connect it to one of the Auxiliary Relay outputs listed above as per the instructions in the relevant installation manual.

3.4 Routine Maintenance

Routine maintenance should be performed in accordance with the relevant Inner Range document;
e.g.
Integriti_Routine_Maintenance.pdf
Inception_Routine_Maintenance.pdf

Disclaimer:

1. The manufacturer and/or its agents take no responsibility for any damage, financial loss or injury caused to any equipment, property or persons resulting from the correct or incorrect use of the system or its peripherals. The purchaser assumes all responsibility in the use of the system and its peripherals.
2. While every effort has been made to ensure the accuracy of this manual, the manufacturer assumes no responsibility or liability for any errors or omissions. Due to ongoing development, product specifications and the contents of this manual are subject to change without notice.

Please send any comments or suggestions regarding this manual to publications@innerrange.com