

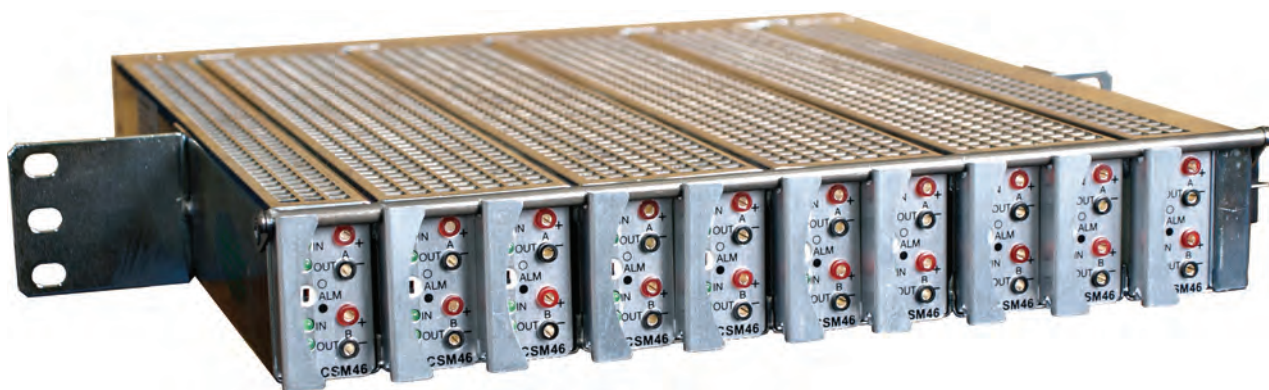


# CSM46 Modular Converter System

## Installation & Operation Manual

Part # 012-554-B2

Effective: 06/2014





## **CSM46 Modular Converter System**

Part # 012-554-B2

The following documents and drawings are included in this manual to provide the necessary information required for installation, routine operation and fault diagnosis of the unit:

- Specifications: 012-554-B1
- Outline Drawing, 10-Module: 030-831-06
- Customer Connections, 10-Module: 030-831-08
- Assembly, I/P Cable, 10-Module: 877-591-04
- Assembly, O/P Cable, 2 feet: 877-593-04
- Assembly, Alarm Cable, 2 feet: 877-594-04
- Assembly, O/P, Molex to Anderson, 6 feet: 877-621-04
- Assembly, Alarm, Molex to Untermated, 6 feet: 877-622-04



# Important Safety Instructions

**SAVE THESE INSTRUCTIONS:** This manual contains important safety instructions that must be followed during the installation, servicing, and maintenance of the product. Keep it in a safe place. Review the drawings and illustrations contained in this manual before proceeding. If there are any questions regarding the safe installation or operation of this product, contact Alpha Technologies or the nearest Alpha representative. Save this document for future reference.

## Safety Symbols

To reduce the risk of injury or death, and to ensure the continued safe operation of this product, the following symbols have been placed throughout this manual. Where these symbols appear, use extra care and attention.

The use of ATTENTION indicates specific regulatory/code requirements that may affect the placement of equipment and /or installation procedures.

### NOTE:

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**A NOTE provides additional information to help complete a specific task or procedure.**



### CAUTION!

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**CAUTION indicates safety information intended to PREVENT DAMAGE to material or equipment. Cautions are designated with a shock hazard icon, the word CAUTION, and a rule beneath which the information appears.**



### WARNING!

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**WARNING presents safety information to PREVENT INJURY OR DEATH to personnel. Warnings are indicated by a shock hazard icon, the word WARNING, and a rule beneath which the information appears.**



### HOT!

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**The use of HOT presents safety information to PREVENT BURNS to the technician or user.**

## General Safety



### WARNING!

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**This system is designed to be installed in a restricted access location that is inaccessible to the general public.**

## Mechanical Safety

- Keep hands and tools clear of fans. Fans are thermostatically controlled and switch on automatically.
- Power supplies can reach extreme temperatures under load.
- Use caution around sheet metal components and sharp edges.

## Electrical Safety



### WARNING!

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**Hazardous voltages are present at the input of power systems. The DC output from rectifiers and batteries, though not dangerous in voltage, has a high short-circuit current capacity that may cause severe burns and electrical arcing.**

Before working with any live battery or power system, follow these precautions:

- Remove all metallic jewelry, such as watches, rings, metal rimmed glasses, or necklaces
- Wear safety glasses with side shields at all times during the installation.
- Use OSHA approved insulated hand tools.



### WARNING!

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**Lethal voltages are present within the power system. Always assume that an electrical connection or conductor is energized. Check the circuit with a voltmeter with respect to the grounded portion of the enclosure (both AC and DC) before performing any installation or removal procedure.**

- Do not work alone under hazardous conditions.
- A licensed electrician is required to install permanently wired equipment. Input voltages can range up to
- 240 Vac. Ensure that the utility power is disconnected and locked out before performing any installation or removal procedure.
- Ensure that no liquids or wet clothes come into contact with internal components.
- Hazardous electrically live parts inside this unit are energized from the batteries even when the AC input power is disconnected.

## Battery Safety

- Servicing and connection of batteries must be performed by, or under the direct supervision of, personnel knowledgeable of batteries and the required safety precautions.
- Always wear eye protection, rubber gloves, and a protective vest when working near batteries. Remove all metallic objects from your hands and neck.
- Use OSHA approved insulated hand tools. Do not rest tools on top of batteries.
- Batteries contain or emit chemicals known to cause cancer and birth defects or other reproductive harm.
- Battery post terminals and related accessories contain lead and lead compounds. Wash your hands after handling batteries.



### WARNING!

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**Follow battery manufacturer's safety recommendations when working around battery systems. Do not smoke or introduce an open flame when batteries (especially vented batteries) are charging. When charging, batteries vent hydrogen gas, which can explode.**

- Batteries are hazardous to the environment and should be disposed at a recycling facility. Consult the battery manufacturer for recommended local authorized recyclers.

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# 1 Introduction

## 1.1 Scope of the Manual

This instruction manual explains the installation and interconnection of Alpha Technologies' CSM46 converter system. Both the converter modules and the shelves, which the modules are plugged into, are covered in this manual.

**NOTE:** *To aid the user with installation, frequent reference is made to drawings located at the rear of this manual.*

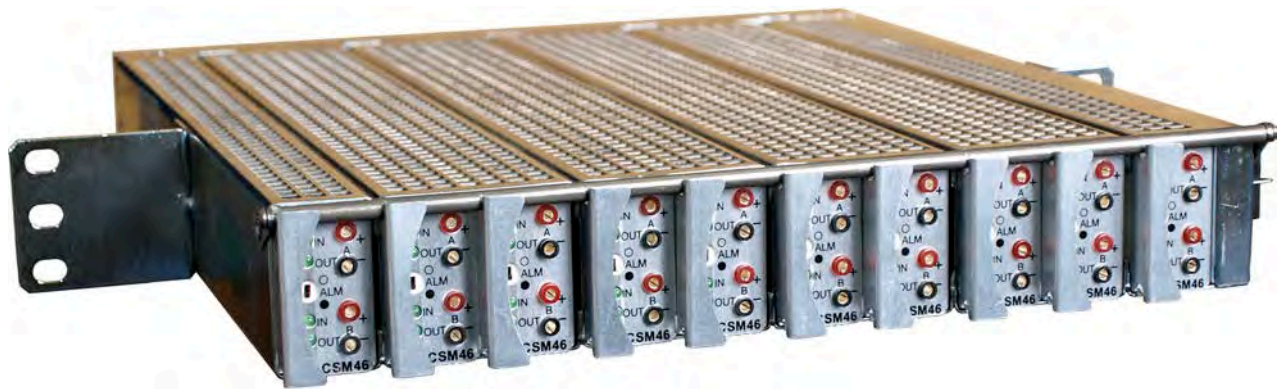
## 1.2 Product Overview

The CSM46 down converter modules employ a high frequency switched mode conversion technique to provide a bulk regulated  $-50$  to  $-55\text{Vdc}$  output from multiple isolated  $\pm 190\text{Vdc}$  inputs. This is directly compatible with Alpha's CSM36  $48\text{Vdc}$  to  $\pm 190\text{Vdc}$  up converters (reference manual #012-552-B2) for use in network powering applications.

Network (a.k.a. Express, Simplex, Remote, Centralized) powering is a method of distributing energy over an existing copper network. Multiple twisted-pair copper is used to distribute  $100\text{VA}$  limited power sources at  $\pm 190\text{Vdc}$ . The individual, isolated inputs are terminated at a remote end and converted back to a bulk  $48\text{Vdc}$  supply.

Each CSM46 module plugs into a common shelf. The shelf (Figure 1 shown below) provides external connections for inputs, output, and alarm interfaces and can accommodate up to ten modules. Additional converter modules can be added to the shelf, at time of ordering or at a later time, after the converter system has been installed.

See Features Section of this manual for more information. See also the Specifications Section of this manual, which details the electrical ratings for each module.



**Figure 1—Perspective view of CSM46 10-module shelf**

1.3 Part Numbers and List Options

This product is available to order under the following part numbers and list options:

Description	Part Number/List Option
CSM46 converter, ±190Vdc to –48V .....	012-554-20
Basic module.....	*List 0
CSM46 10-module 1 RU 12" shelf .....	030-831-20
Basic unit.....	*List 0
Input wire harness 25-pair ±190Vdc .....	List 80
Output wire harness (Molex) 2 feet 48Vdc.....	List 84
Output wire harness (Molex/Anderson) 6 feet 48Vdc .....	List 85
Alarm output wire harness (Molex) 2 feet .....	List 87
Alarm output wire harness (Molex/flying leads) 6 feet .....	List 88
Alarm relay replacement, Tyco 3-1393190-1 (T7CS5D-48) .....	491-403-19
CSM46 blank module .....	615-278-D5

\* Default option

The above information is valid at the time of publication. Consult factory for up-to-date ordering information.

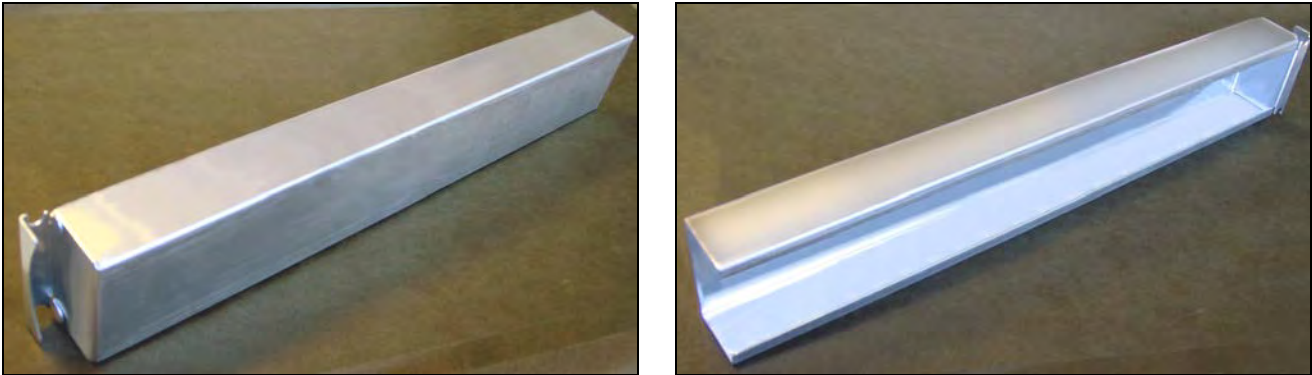


Figure 2–Front and rear perspective views of the optional CSM46 blank module

1.4 Accessories

The following accessories can be ordered with this product:

Description	Part Number
19" rack flush mount kit (see Figure 6) .....	0370049-001
O/P wire harness, 8 feet, 1/4" ring lug .....	8700270-001

## 2 Converter Module Features

Each module contains two isolated DC to DC converters with a control and supervisory circuit. Each module operates independently.

The Specifications Section of this manual details the electrical ratings for each module.

The converter modules plug into the converter shelf. The modules can be installed or removed from a system without disturbing the system provided sufficient current capacity remains. This is often referred to as “Hot Swap.”

The total output current capacity of the converter system is equal to the sum of the individual current capacities of the converter modules.

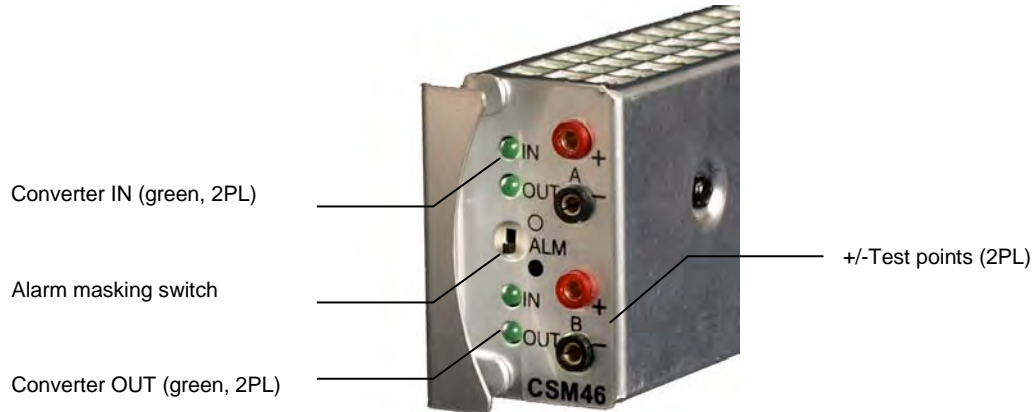


Figure 3—CSM46 converter module front panel

### 2.1 Microcontroller

The microcontroller monitors both the inputs and outputs of the converters, turns the converters on and off and generates a converter fail alarm if required.

### 2.2 Indicators

LED indicators are provided on the front panel of the converter module to display the operational status of the module.

#### 2.2.1 IN

The power IN LED indicator illuminates when the converter module is getting power from the shelf (input voltage is in the normal range) and is not shorted or otherwise in a fail condition.

#### 2.2.2 OUT

The power OUT LED indicator illuminates when the converter module is not in a fail condition (see below); the output voltage is in the normal range.

### 2.3 Fail Alarm

The converter module is equipped with a converter fail alarm, which is extended to the alarm relay contacts. Converter fail alarm discrimination circuitry is factory set. The alarm is latched for approximately thirty seconds to prevent strobing<sup>1</sup> of the alarm output. The alarm will be extended if the input or output voltages of the module falls outside factory set limits, input fuses fail, the OVP shutdown operates, the over temperature shutdown operates, or if the internal regulation fails. An output short circuit will also trigger this alarm. If the module returns to normal regulation the alarm will clear.

<sup>1</sup> Generating multiple alarms for the same fault condition.

## 2.4 Alarm Masking Switch

This feature prevents (masks) Minor Alarm reporting for unused feeds. The alarm LEDs are not masked. The switch in the UP position will mask alarming. The switch in the DOWN position will enable alarming for the converter module.

## 2.5 Test Points

Each converter module has front access, insulated, current limited meter probe test points for each  $\pm 190\text{Vdc}$  input feed. Use a voltmeter set to  $>20\text{M}\Omega$  input resistance to allow for accurate ( $<2\%$  error) input voltage measurement.

## 2.6 Output Power

Each of the two isolated converters on each CSM46 module has a maximum output capacity of 75W (for a total capacity of 150W per module). The power output is a function of the input voltage into each converter. Proper network engineering and copper pair sizing is a requirement for meeting the power demand of the load.

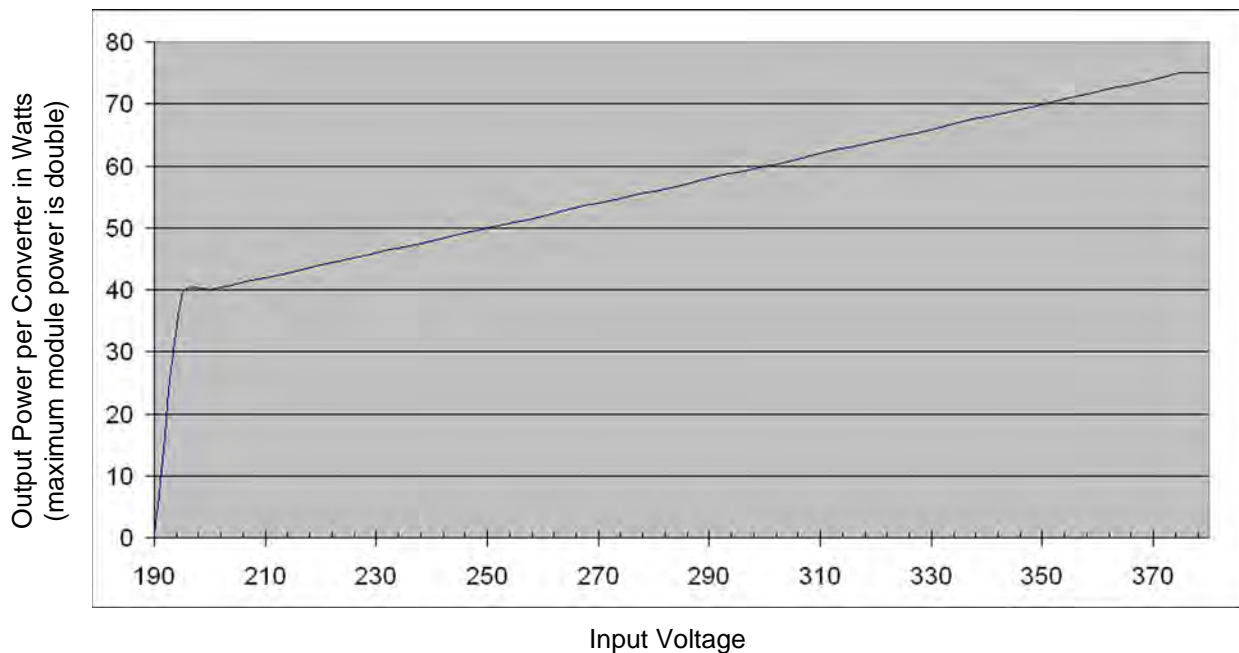


Figure 4–Power per converter

## 2.7 Over Voltage Protection (OVP)

The OVP feature safeguards the module and load from converter over voltage conditions. If an over voltage condition is detected on a converter output, the OVP will shutdown the corresponding output. The OVP shutdown level is factory set. Once an over voltage condition is sensed, the microcontroller for that output will attempt to restart repeatedly.

## 2.8 Current Limit

The current limiting function provides a primary response to output overload situations. When the converter output is in current limit, its front panel OUT LEDs are off.

## **2.9 Input Low Voltage Lockout**

The converter module is electronically protected from low voltages at the inputs by fault detection circuitry. If the input to the converter module falls below the lower DC input limit (see Specifications), the module will shut down and enter converter fail mode.

## **2.10 Regulation and Paralleling**

Alpha modular converters use “output slope” or “regulation offset” to accomplish load sharing.

## **2.11 Over Temperature Protection**

The converter module is protected in the event that it is operated in excessive ambient temperatures or if the cooling airflow is compromised such as that caused by airflow obstruction or operation at high altitudes. Under these conditions the converter will shut down causing the corresponding OUT LED to flash. Normal outputs will be returned automatically if the ambient temperature is reduced.

## **2.12 Ventilation**

Cooling of the converter module is achieved via bottom to top natural convection and/or forced air-cooling. To maintain proper operation over the full temperature range (see Specifications), allow at least one rack space above and below the converter shelf with airflow baffles deflecting any heated air away from the input (bottom) of the converter shelf. The 4-module shelf has an integrated fan.

## **2.13 Paralleling Diode**

Converter modules are equipped with a paralleling diode to ensure uninterrupted operation of the system in case of failure of one converter module.

## **2.14 Reverse Polarity Protection**

The converter design has incorporated reverse polarity protection from the connection to a power source on the input. This prevents damage to the converter circuitry if a reverse connection is made.

### **CAUTION**

**To ensure some measure of safety, it is recommended to wire the shelf with correct polarity on all inputs as measured at the front panel test points.**

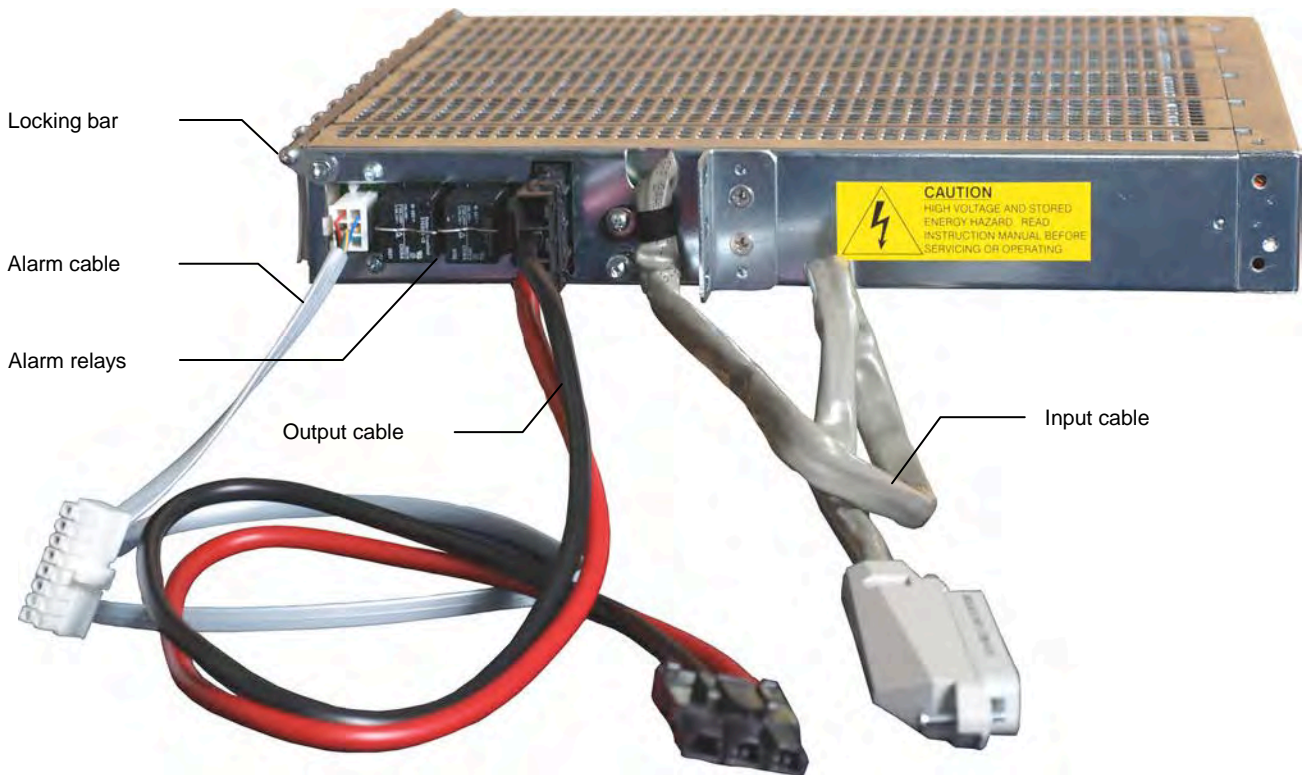
### 3 Converter Shelf Features

The current shelf system for the CSM46 is a 12" 10-module design: Alpha #030-831-20.

This shelf configuration accommodates up to ten CSM46 DC-DC converter modules. A fully equipped system provides for up to twenty  $\pm 190\text{Vdc}$  inputs and can output up to 1500 Watts bulk power for 48Vdc loads.

The shelf system provides front accessibility for operation and customer connections.

The system is a natural convection cooled unit and does require external airflow for operation in temperatures above 40°C (104°F). The Specifications Section at front of this manual details the temperature operation constraints.



**Figure 5—Side view of CSM46 10-module shelf connections (typical)**

(Photo is for reference only – subject to installation requirements)

**NOTE:** Refer also to drawings located at the rear of this manual.

#### 3.1 Module Locking Bar

A locking bar is provided on the shelf to secure the converter modules in place during operation. The bar rotates up to allow for module insertion/removal. The bar rotates down, locking into the handle of each module, to secure the modules in place.

#### 3.2 Site (Chassis) Ground

The left side mounting bracket (looking at front of unit) contains a set of PEM studs for site ground connection.

#### 3.3 DC Input

The shelf comes factory configured with a 50-pin Amp-Champ style connector and 25-pair wire for input of the twenty input power pairs (which require customer-supplied overvoltage protectors at the host system).

## 3.4 DC Output

### 3.4.1 Shelf Connection

The 10-module shelf has a 3-position Molex style connector for the –48V and +Gnd output terminations.

### 3.4.2 Wire Harness Options

The 10-module shelf has two options for DC output wiring:

**Shelf List Option 84:** provides a wire harness two feet long with a 3-position Molex connector on the customer connection end.

**Shelf List Option 85:** provides a wire harness six feet long with a 2-position Anderson style connector on the customer connection end.

## 3.5 Alarm Cable/Relays

The 10-module shelf system can extend both major and minor alarm outputs via Form C relays; which are socketed and field replaceable (See 1.3 Part Numbers and List Options for ordering information).

### 3.5.1 Major Alarm

**NOTE:** *Major alarm relay is designed to “fail safe” to ensure alarm is registered when power is removed.*

The Major alarm relay will be de-energized under any one of the following conditions:

- When a converter module has failed,
- When two or more outputs have failed,
- When two of the input feeds are below the normal operating voltage,
- When two of the input feeds are above the normal operating voltage.

### 3.5.2 Minor Alarm

The Minor alarm relay will be energized under any one of the following conditions:

- When one half of a converter module has failed,
- When one of the input feeds are above or below the normal operating voltage,
- When the internal ambient temperature exceeds the specified limit.

### 3.5.3 Shelf Connection

The 10-module shelf has a Molex style connector for the major and minor alarm relay terminations.

### 3.5.4 Wire Harness Options

The 10-module shelf has two options for factory alarm wiring:

**Shelf List Option 87:** provides a wire harness two feet long with a 16-position Molex connector on the customer connection end.

**Shelf List Option 88:** provides a wire harness six feet long with unterminated wires (flying leads) on the customer connection end.



## 4 Inspection

### 4.1 Packing Materials

All Alpha products are shipped in rugged, double walled boxes and suspended via solid inserts to minimize shock that may occur during transportation. Packaging assemblies and methods are tested to International Safe Transit Association standards.

Products are also packaged with Cortex. This plastic wrap contains a corrosive-inhibitor that protects the product from corrosion for up to two years.

#### 4.1.1 Returns for Service

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is unavailable, make sure the product is packed with at least three inches of shock-absorbing material to prevent shipping damage.

**NOTE:** *Alpha Technologies is not responsible for damage caused by the improper packaging of returned products.*

### 4.2 Check for Damage

Prior to unpacking the product, note any damage to the shipping container. Unpack the product and inspect the exterior for damage. If any damage is observed contact the carrier immediately.

Continue the inspection for any internal damage. In the unlikely event of internal damage, please inform the carrier and contact Alpha Technologies for advice on the impact of any damage.



**Verify that you have all the necessary parts per your order for proper assembly.**



## 5 Installation

This chapter is provided for qualified personnel to install the product, which shall be mounted in a clean and dry environment.

**NOTE:** *To aid the user with installation, frequent reference is made to drawings located at the rear of this manual.*

### 5.1 Safety Precautions



#### **WARNING**

Hazardous voltages are present at the input of converter/rectifier systems. The DC output, from the converters/rectifiers and the battery system, has a high short circuit current capacity that may cause severe burns and electrical arcing.



#### **WARNING**

The intra-building ports (Ethernet, CAN, alarm relays) of the equipment or subassembly are suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly **MUST NOT** be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

Before working with any live battery or power system/distribution center, follow these precautions:

- Remove all metallic jewelry; e.g., watches, rings, metal rimmed glasses, necklaces.
- Wear safety glasses with side shields (and prescription lenses if necessary) at all times during installation.
- Use OSHA approved insulated hand tools.

The installer should follow all applicable local rules and regulations for electrical and battery installations; e.g., CSA, UL, CEC, NEC, OSHA, and local fire codes.

#### **CAUTION**

The CSM46 is suitable for installation as part of the Common Bonding Network (CBN).

The CMS46 is suitable for connection to the (Central Office, NEC)

The CMS46 must be grounded via a copper ground conductor.

Before making connections all bare grounding connection points to the CMS46 must be cleaned and coated with an anti-oxidant solution.

Before making connections all surfaces on the CMS46 that are un-plated must be brought to a bright finish and treated with an anti-oxidant solution.

To ensure electrical continuity, all non-conductive surfaces on the LPS36 should be removed from all threads and all connection points.

The CMS46 utilizes a 2-hole compression lug with a #6 AWG wire that utilizes 8.8 ft-lbs torque to secure it to the frame and CMS46.

### 5.2 Tools Required

Various insulated tools are essential for product installation. Use this list as a guide:

- Philips head screwdriver, #2 (tip size 3/16")
- Slot head screwdriver (1/4" x #6)
- High impedance (>20M $\Omega$ ) digital voltmeter equipped with test leads
- Cutters, crimping tool and wire strippers 0.34 to 10mm<sup>2</sup> (#22 to #8 AWG).

### 5.3 Shelf Preparation/Mounting

See drawings 030-821-06 and 030-903-06.

**NOTE:** *Mount the shelf in a clean and dry environment. Allow at least 1.75" of free space above and below the unit for unrestricted cooling airflow. A customer-supplied DC fan tray can occupy part or all of the required space below the shelf and it is recommended to allow a minimum of 2RU (3.5") below a DC fan tray for removal and servicing of the fans and/or fuses.*

Mounting brackets accommodate either 1" or 1-3/4" rack spacing. The shelf should be mounted to the rack using at least two #12 – 24 x 1/2" screws in each bracket. Philips-type screws and screwdriver should be used to eliminate the possibility of slippage and scratching of the unit's exterior. Use washers, which are designed to cut through the painted surface (such as internal tooth), or special screws to ensure a good chassis ground.

To attach a 19" rack mount kit, see Figure 6.

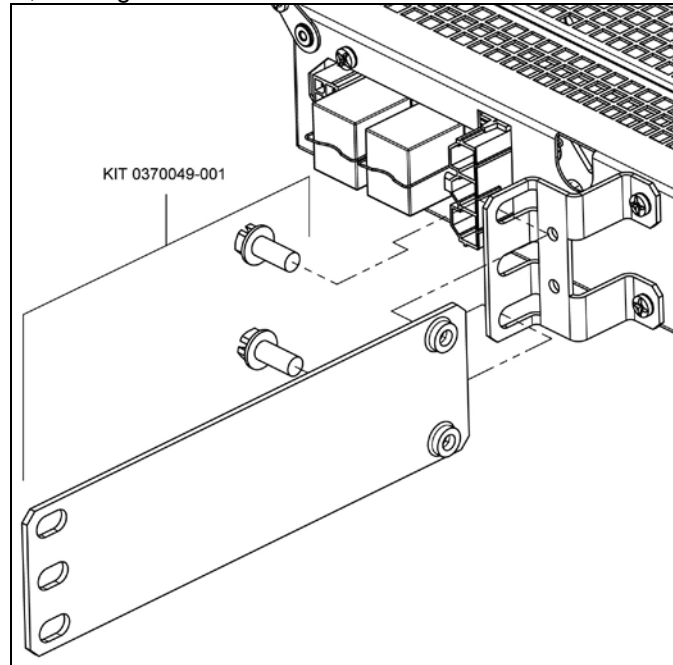


Figure 6–19" rack flush mount kit

### 5.4 Module Insertion/Removal

To insert a module: lift locking bar, place the module on the shelf bottom, and slide the module into the rear connector (inside of the shelf). Apply pressure on the module handle to engage the rear connector in the shelf receptacle.

**NOTE:** *It is recommended that the first module be inserted into the front rightmost position using the side of the shelf as a guide. The next module may be inserted using the previous module as a guide. Do not force a module into position if it does not seat properly. All modules are keyed to ensure that the correct module (polarity/voltage) type is used.*

To remove a module: lift locking bar, grasp module handle and pull out, sliding the module away from the rear connector and out of the shelf.

**NOTE:** *Replacing a rectifier with a new one requires a manual **Inventory Update** at the controller before installing the new rectifier. This command (**Main Menu > Rectifiers > Inventory Update**) clears the removed rectifier from the controller's current list of rectifiers.*

## 6 Wiring and Connections

### 6.1 Safety Precautions



#### **WARNING**

For safety reasons, ensure the shelf is properly bonded to the enclosure's ground grid.

Input voltage shall meet UL60950-21 RFT-V requirements. **DO NOT CONNECT TO RFT-C CIRCUITS.**

Chassis must be permanently grounded.

-48V return (RTN) shall be earthed.

Telecom cable carrying  $\pm 190\text{V}$ , shall be #26 AWG minimum (rated 200V minimum).

Primary over voltage protection must be provided on all input pairs.

Insulation of the outside plant conductors should be rated  $>90^{\circ}\text{C}$  ( $194^{\circ}\text{F}$ ).

Insulation of the wiring inside the enclosed equipment cabinets should be rated  $105^{\circ}\text{C}$  ( $221^{\circ}\text{F}$ ) minimum. Cables must be dressed to avoid damage to the conductors.

The designed capacitance between  $+190\text{V}$  and  $-190\text{V}$  RFT-V conductors is  $7\mu\text{F}$  and the measured capacitance between  $\pm 190\text{V}$  conductors and earth is  $<1\mu\text{F}$ .



Current limiting protection must be provided for the contacts of the alarm relays as they are not fused in the shelf. **EXCEEDING MAXIMUM RATINGS OF 60Vdc AND 0.5A COULD RESULT IN FIRE OR DAMAGE OF THE CONTACTS.**

For installations in environments exceeding  $40^{\circ}\text{C}$  ( $104^{\circ}\text{F}$ ), airflow must be provided at a rate of 150 LFM across the entire cross section of the shelf.

This equipment is to be used in controlled environments.

Load connections should be made in close proximity to the power shelf.

Refer to the previous (Installation) chapter for additional safety precautions.

### 6.2 Site (Chassis) Ground

The left side mounting bracket (looking at front of unit) contains a set of 1/4" PEM studs on 5/8" centers for site ground connection. Refer to drawing 030-831-08, at the rear of this manual, for site/chassis ground location.

### 6.3 DC Input

The shelf comes factory configured with a 50-pin Amp-Champ style connector and 25-pair wire for input of the twenty (20) input power pairs.

**NOTE:** *The host system must provide input primary overvoltage protection, for each of the 20 telephone wire pairs, to a level corresponding to a 5-pin solid-state protector type Corning 303M-11A7T0 or a 5-pin multi-stage protector type Bourns 2410-31-G-MSP. These modules are designed to short-to-ground for all electrical conditions that exceed their surge capabilities and have a DC breakdown voltage range of 300-400 Volts and an impulse breakdown voltage of  $<700$  Volts.*

Refer to drawing 030-831-08, at the rear of this manual, for pin out assignments and mating connector requirements.

## 6.4 DC Output

### 6.4.1 Shelf Connection

The 10-module shelf has a 3-position Molex style connector for the –48V and +Gnd output terminations. Refer to drawing 030-831-08, at the rear of this manual, for pin out assignments and mating connector requirements.

### 6.4.2 Wire Harness Options

The 10-module shelf has two (2) options for DC output wiring:

**Shelf List Option 84:** provides a wire harness two (2) feet long with a 3-position Molex connector on the customer connection end. Refer to drawing 877-593-04, at the rear of this manual, for pin out assignments.

**Shelf List Option 85:** provides a wire harness six (6) feet long with a 2-position Anderson style connector on the customer connection end. Refer to drawing 877-621-04, at the rear of this manual, for pin out assignments.

## 6.5 Alarm (Relay) Outputs

The 10-module shelf system can extend both major and minor alarm outputs via Form C relays; which are socketed and field replaceable (See 1.3 Part Numbers and List Options for ordering information).

Each relay output can be wired for NO or NC operation during an alarm or control condition. See Figure 7.

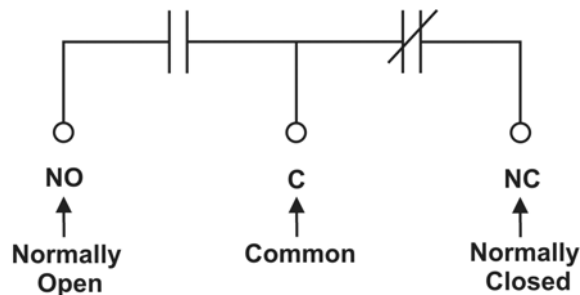


Figure 7—Showing relay connections

### 6.5.1 Shelf Connection

The 10-module shelf has a 6-pin Molex style connector for the major and minor alarm relay terminations. Refer to drawing 030-831-08, at the rear of this manual, for pin out assignments and mating connector requirements.

### 6.5.2 Wire Harness Options

The 10-module shelf has two (2) options for factory alarm wiring:

**Shelf List Option 87:** provides a wire harness two (2) feet long with a 16-position Molex connector on the customer connection end. Refer to drawing 877-594-04, at the rear of this manual, for pin out assignments.

**Shelf List Option 88:** provides a wire harness six (6) feet long with unterminated wires (flying leads) on the customer connection end. Refer to drawing 877-622-04, at the rear of this manual, for pin out assignments.

## 7 Initial Startup

Remove customer-supplied 5-pin protectors from power-pairs termination block and disconnect the output –48V cable.

Verify by both measurement and observation that the chassis of the system is bonded to ground.

Mate the input connector with the host connector.

Insert all modules as per Section 5.4.

Complete the input circuits by plugging in the 5-pin protectors, one by one, and confirm that both the IN and OUT LED indicators illuminate on corresponding modules.

Measure the output voltage to be <58Vdc and reconnect the output –48V cable.

### 7.1 Normal Mode of Operation

Normal operation of the converter system will be indicated by the illumination of the LED indicators on each converter module.

### 7.2 Reverse Polarity Protection

The converter module will not be damaged and will operate if an input connection is made in reverse.

#### **CAUTION**

**To ensure some measure of safety, it is recommended to wire the shelf with correct polarity on all inputs as measured at the front panel test points. The circuits with incorrect polarity should be reversed.**

## 8 Maintenance

Although very little maintenance is required with Alpha systems, routine checks and adjustments are recommended to ensure optimum system performance. Qualified service personnel should do repairs.

The following table lists a few maintenance procedures for this system. These procedures should be performed at least once a year.



### **WARNING: HIGH VOLTAGE AND SHOCK HAZARD.**

**Use extreme care when working inside the shelf while the system is energized.  
Do not make contact with live components or parts.**



**Circuit cards, including RAM chips, can be damaged by static electricity. Always wear a grounded wrist strap when handling or installing circuit cards**

**Ensure redundant modules or batteries are used to eliminate the threat of service interruptions while performing maintenance on the system's alarms and control settings.**

Procedure	Date Completed
Clean ventilation openings	
Inspect all system connections (re-torque as necessary)	
Verify alarm relay operation	

**Table A—Sample maintenance log**

**NOTE:** Consult factory for replacement parts. See 1.3 Part Numbers and List Options for ordering information.

### 8.1 Output Relay Replacement

Relays are located immediately behind the alarm cable at the front right side of the converter shelf.

1. Remove the hold-down spring securing the relay in its socket.
2. Carefully remove/replace the relay (**replace only with same type and rating**).
3. Replace the hold-down spring.

## 9 Warranty

Visit <http://www.alpha.ca/web2/services-and-support/warranty.html> for full warranty information.

### 9.1 Warranty

Alpha Technologies Ltd. warrants all equipment manufactured by it to be free from defects in parts and labor, for a period of two years from the date of shipment from the factory. The warranty provides for repairing, replacing or issuing credit (at Alpha's discretion) for any equipment manufactured by it and returned by the customer to the factory or other authorized location during the warranty period. There are limitations to this warranty coverage. The warranty does not provide to the customer or other parties any remedies other than the above. It does not provide coverage for any loss of profits, loss of use, costs for removal or installation of defective equipment, damages or consequential damages based upon equipment failure during or after the warranty period. No other obligations are expressed or implied. Warranty also does not cover damage or equipment failure due to cause(s) external to the unit including, but not limited to, environmental conditions, water damage, power surges or any other external influence.

The customer is responsible for all shipping and handling charges. Where products are covered under warranty Alpha will pay the cost of shipping the repaired or replacement unit back to the customer.

## 10 Acronyms and Definitions

AC	Alternating current
AWG	American wire gauge
CEC	Canadian Electrical Code
CMA	Circular mil area
CSA	Canadian Standards Association
DC	Direct current
LED	Light emitting diode
NC	Normally closed
NEC	National Electrical Code (for the USA)
NO	Normally open
OSHA	Occupational Safety & Health Administration
OVP	Over voltage protection
RU	Rack unit (1.75")
UL	Underwriters Laboratories



# Specifications for Alpha Technologies' Modular Converter System CSM46

## Converter Module Output

Voltage Range:	-50 to -55Vdc
Current Maximum:	1.5A per converter (derates linearly with input voltage) 3.0A per module
Power:	$\leq 75\text{W}$ per converter (derates linearly with input voltage) $\leq 150\text{W}$ per module
Static Voltage Regulation:	55V $\pm 1\%$ @ no load 50V $\pm 1\%$ @ full load (1.5A x2)
Startup Time:	$\leq 0.3$ seconds to rated Vdc @ no load
Startup Overshoot:	-60Vdc in less than 100ms, no OVP
Current Limit:	1.5A x2 $\pm 2\%$
Noise:	$< 100\text{mVRMS}$ to 20MHz (wide band) $< 500\text{mVp-p}$ to 20MHz Meets requirements of GR-1089-CORE, Section 3.2.2.2 with test method of Section 3.4.5
Acoustic Noise:	$< 45\text{dBA}$ at 1m (3 ft)
Transient Protection:	Compliant to GR-1089-CORE, Section 4.6.7 for lightning surge susceptibility Section 4.6.10 for ac power faults
EMI:	Meets requirements of GR-1089-CORE, Sections 3.2.2.2 and 3.3

## Converter Module Input

Voltage:	200 to 380Vdc ( $\pm 100$ to $\pm 190\text{Vdc}$ )
Noise:	Compliant to GR-1089-CORE, Section 3.2.2.2 and 3.3
Current:	Up to 0.235A(dc) $\pm 2\%$ per input
Efficiency:	$> 85\%$ @ 100% load
Off State Current:	$< 30\text{mA}$ input current when module is turned off
Power Module Fuse:	4 x 1.25A, 250Vac Telecom
Isolation:	Inputs isolated from outputs and ground; 10M $\Omega$ insulation resistance and $\geq 1600\text{Vdc}$ insulation strength

## Environmental

Temperature:	-40 to +40°C (-40 to +104°F) [natural convection] -40 to +75°C (-40 to +167°F) [with 200 LFM airflow] -40 to +65°C (-40 to +149°F) [with 150 LFM airflow]
Humidity:	0 to 95% non-condensing
Elevation:	-500 to 2800 m (-1640 to 9186 ft)

## Module Features

Indicators:                      Green LED – Converter A Input OK  
                                        Green LED – Converter A Output OK  
                                        Green LED – Converter B Input OK  
                                        Green LED – Converter B Output OK

Test Points:                      Converter A Input Voltage  
                                        Converter B Input Voltage

## Recommended Connection Wire Sizes

10-Module Shelf:                Input: 0.34 to 0.14 mm<sup>2</sup> (#22 to 26 AWG) [20 pairs, 40 conductors]  
                                        Output: 2 x 10 mm<sup>2</sup> (#8 AWG)  
                                        AMBIENT TEMPERATURE = 40°C (104°F)

## Mechanical

SIZE:

    Converter Module:            42mm H x 23mm W x 280mm D  
                                        (1.65" H x 0.90" W x 11" D)

    10-Module Shelf:            45mm H x 273mm W x 311mm D [excludes connectors and mounting brackets]  
                                        (1.75" H x 10.75" W x 12.25" D)

MOUNTING:

    10-Module Shelf:            12" or 19" flush or offset mounting

WEIGHT:

    Converter Module:            0.67 kg (1.5 lb.)

    10-Module Shelf:            4.87 kg (10.8 lb.)

## Standards Compliance

This product is certified to meet or exceed the following:

### PRODUCT SAFETY

    United States:                UL 60950-1-2002  
                                        UL 60950-21 (RFT-V)  
                                        Telcordia GR-1089-CORE, Issue 3 Oct 2002 Section 7

    Canada:                        CSA C22.2 60950-1-03  
                                        CSA 60950-21 (RFT-V)

    Europe:                        EN 60950-1  
                                        IEC 60950-1  
                                        IEC 60950-21 (RFT-V)

### EMI/RFI/EMC

    United States:                FCC Title 47, 2002, Chapter 1, Part 15 Class B  
                                        (Class A for a complete rack mounted system)  
                                        Telcordia GR-1089-CORE, Issue 3 Oct 2002

    Canada:                        ICES-003 Issue 3, Nov 22, 1997

## Specifications for Alpha Technologies' Modular Converter System CSM46 Continued

This product is designed to meet or exceed the following:

### EMI/RFI/EMC

Europe:	EN-ETS 300 386 ERM and EMC EN 55024, 1998
---------	--

### ENVIRONMENTAL

United States:	Telcordia GR-63-CORE, Issue 2, Apr 2002 GR-499 Section 13
----------------	--

Europe:	EN 300 019, 1998
---------	------------------

### OTHER RELEVANT TELCORDIA DOCUMENTS

GR-57-CORE, Issue1:	Functional Criteria for Digital Loop Carrier (DLC) Systems
---------------------	--

GR-909-CORE, Issue 1:	Generic Requirements for Fiber Loop Systems
-----------------------	---

SR-332, Issue 1:	Reliability Prediction for Electronic Equipment
------------------	---

TA-NWT-001500, Issue 1:	Generic Requirements for Powering Optical Network Units in FITL Systems
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GR-950-CORE:	Generic Requirements for Optical Network Unit (ONU) Closures
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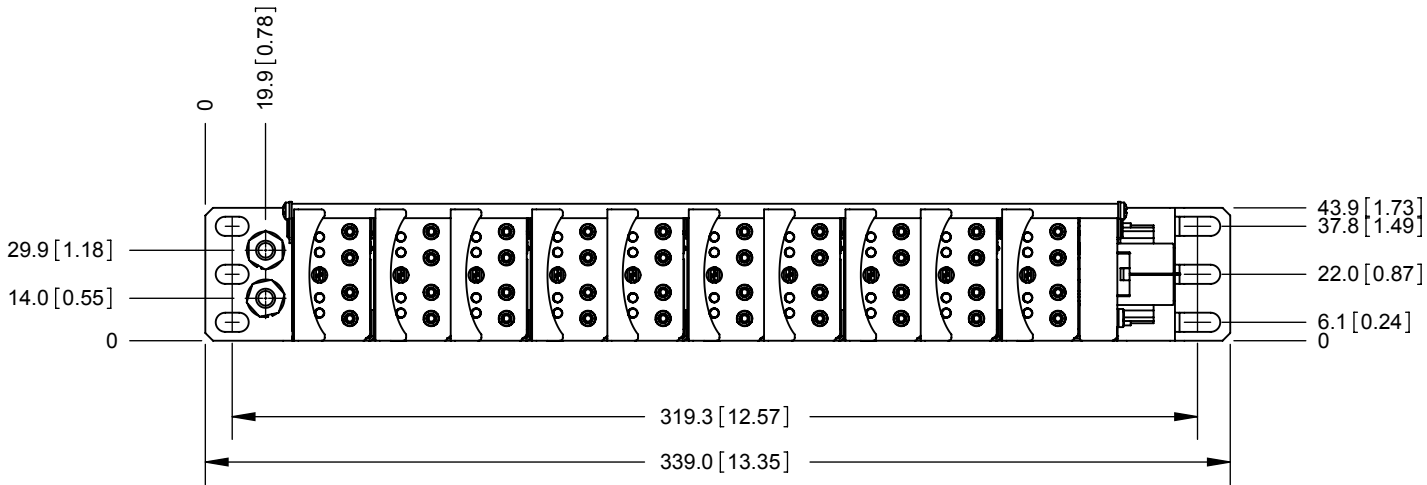
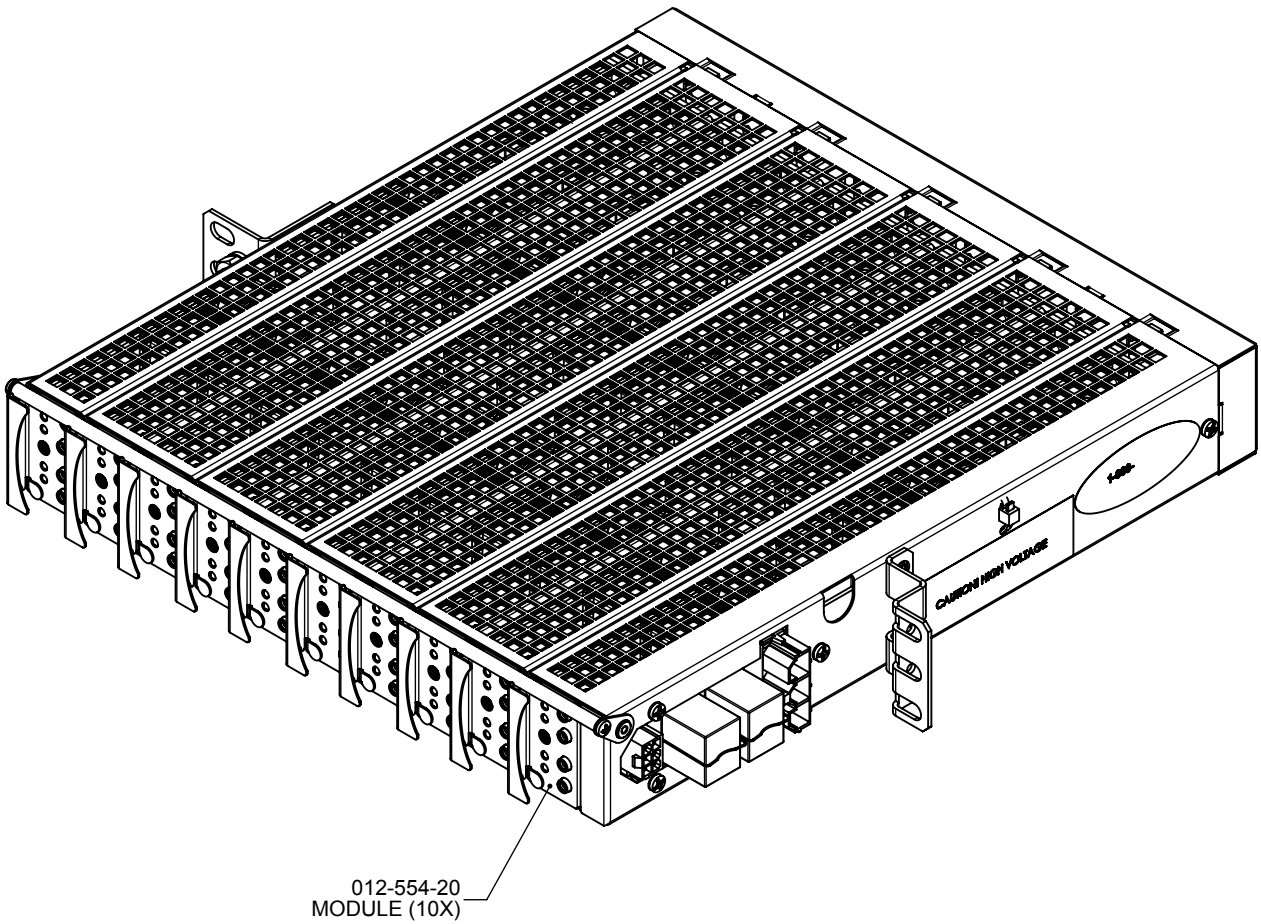
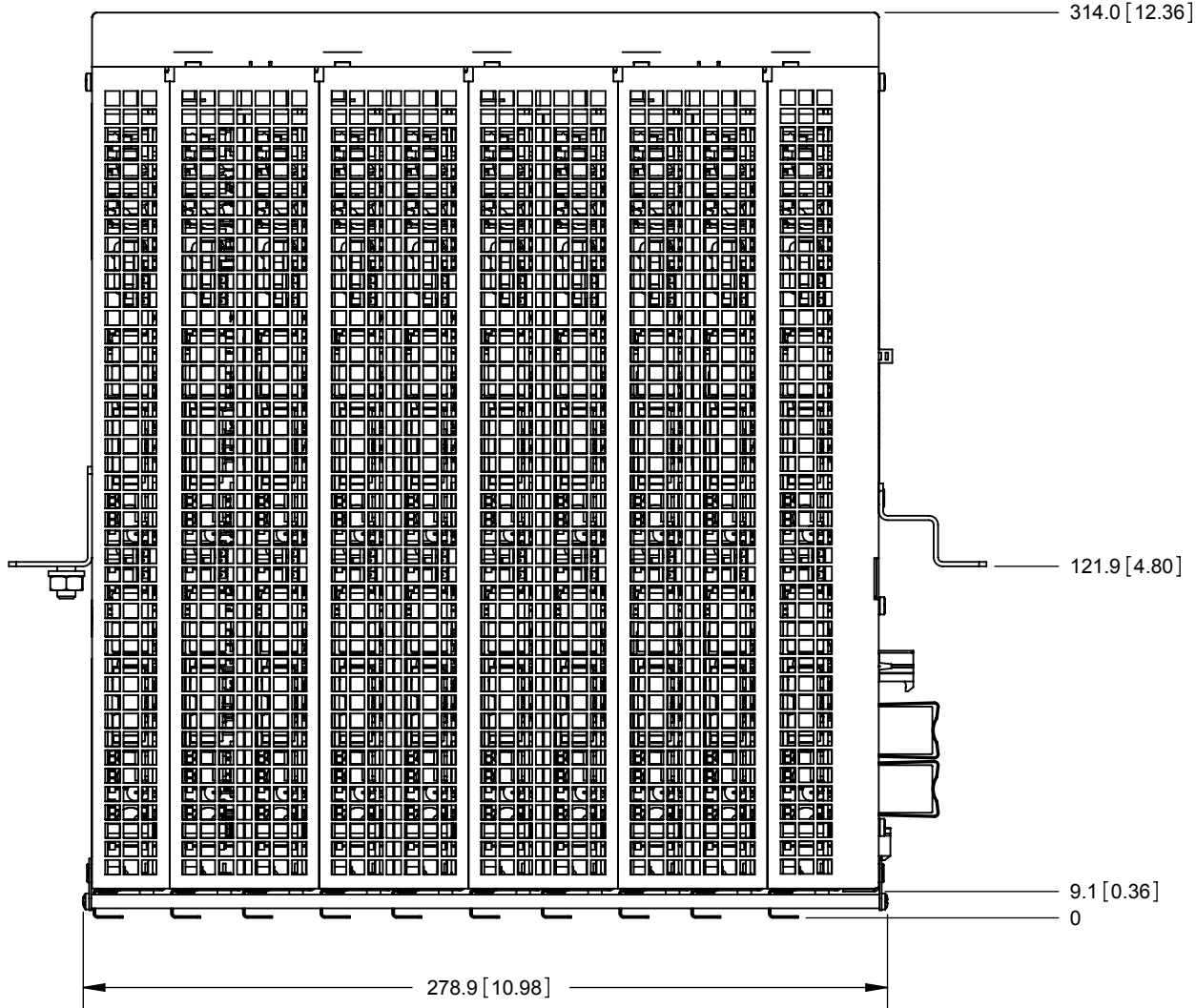
*The above information is valid at the time of publication. Consult factory for up-to-date ordering information.  
Specifications are subject to change without notice.*



## 10 Acronyms and Definitions

AC	Alternating current
AWG	American wire gauge
CEC	Canadian Electrical Code
CMA	Circular mil area
CSA	Canadian Standards Association
DC	Direct current
LED	Light emitting diode
NC	Normally closed
NEC	National Electrical Code (for the USA)
NO	Normally open
OSHA	Occupational Safety & Health Administration
OVP	Over voltage protection
RU	Rack unit (1.75")
UL	Underwriters Laboratories

DO NOT SCALE DRAWING

REVISIONS				
LTR	DESCRIPTION	DWN	DATE	APPD
B	REV'D FOR INTEGRATE	JL	2014/04	KLau



UNLESS OTHERWISE SPECIFIED DIM ARE IN MM		THESE DESIGNS AND SPECIFICATIONS ARE CONFIDENTIAL, REMAIN THE PROPERTY OF ALPHA TECHNOLOGIES LTD., AND SHALL NOT BE COPIED OR USED WITHOUT ITS WRITTEN CONSENT			
X	1				
X.X	0.5				
X.XX	0.25				
ANGULAR:	±1°				
INTERPRET DIM AND TOL PER ASME Y14.5M-1994		APPROVALS		DATE	
		DRAWN SY		2008/02	
THIRD ANGLE PROJECTION		CHECKED RPo		2008/02	
				TITLE: OUTLINE DRAWING, SHELF 10 MODULE, CSM46	
		© ALPHA TECHNOLOGIES LTD		SIZE B DWG NO. 030-831-06 REV B	
				SCALE: NTS SHEET 1 OF 1	

DO NOT SCALE DRAWING

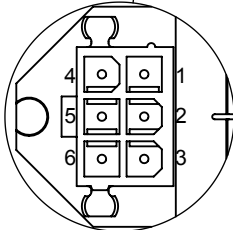
REVISIONS				
LTR	DESCRIPTION	DWN	DATE	APPD
B	ALARM OUTPUT CORRECTED	SY	2008/08	MC
C	REV'D FOR INTEGRATE	JL	2014/04	KLau

MINOR ALARM RELAY

MAJOR ALARM RELAY

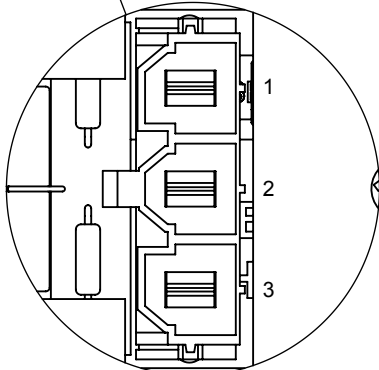
CAUTION! HIGH VOLTAGE

1-800-



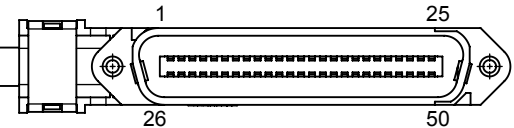
MATE WITH MOLEX P/N 39-01-2065

ALARMS	
PIN	FUNCTION
1	MINOR ALARM NO
2	MINOR ALARM COMMON
3	MINOR ALARM NC
4	MAJOR ALARM NO
5	MAJOR ALARM COMMON
6	MAJOR ALARM NC



MATE WITH MOLEX P/N 42816-0312

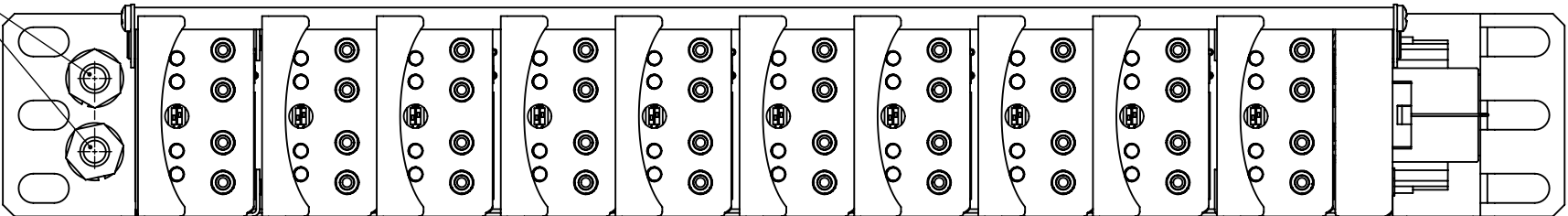
DC OUTPUT	
PIN	FUNCTION
1	NO CONNECTION
2	-48V
3	RTN



MATE WITH TYCO AMP KIT P/N 1-229913-1 (NON-ROHS) OR 1-5229913-1 (ROHS). THE CABLE HOUSING SHOULD BE DRESSED AWAY FROM PINS 1 AND 26, WITH BUNDLE EXITING OVER PINS 25 AND 50

DC INPUT		
-190V PIN	+190V PIN	PAIR
1	26	1
2	27	2
3	28	3
4	29	4
5	30	5
6	31	6
7	32	7
8	33	8
9	34	9
10	35	10
11	36	11
12	37	12
13	38	13
14	39	14
15	40	15
16	41	16
17	42	17
18	43	18
19	44	19
20	45	20
PINS 21-25 AND 46-50 ARE NOT CONNECTED		

CHASSIS GROUND 1/4-20 STUDS AND HARDWARE (SUPPLIED)



UNLESS OTHERWISE SPECIFIED DIM ARE IN MM X 1 X.X 0.5 X.XX 0.25 ANGULAR: ±1° INTERPRET DIM AND TOL PER ASME Y14.5M-1994 THIRD ANGLE PROJECTION		THESE DESIGNS AND SPECIFICATIONS ARE CONFIDENTIAL, REMAIN THE PROPERTY OF ALPHA TECHNOLOGIES LTD., AND SHALL NOT BE COPIED OR USED WITHOUT ITS WRITTEN CONSENT		APPROVALS DATE DRAWN SY 2008/02 CHECKED RPo 2008/02		TITLE: CUSTOMER CONNECTIONS, SHELF 10 MODULE, CSM46	
© ALPHA TECHNOLOGIES LTD		SCALE: NTS		SHEET 1 OF 1		REV C	

REVISIONS				
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C	CINCH CHANGED TO AMP SHEET 2 ADDED	WH	2008/09	MC

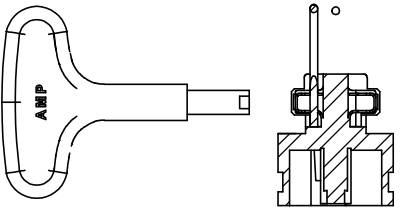
WIRE INSTALATION

PIN 1 TO 20 (NEGATIVE)  
PIN 26 TO 45 (POSITIVE)

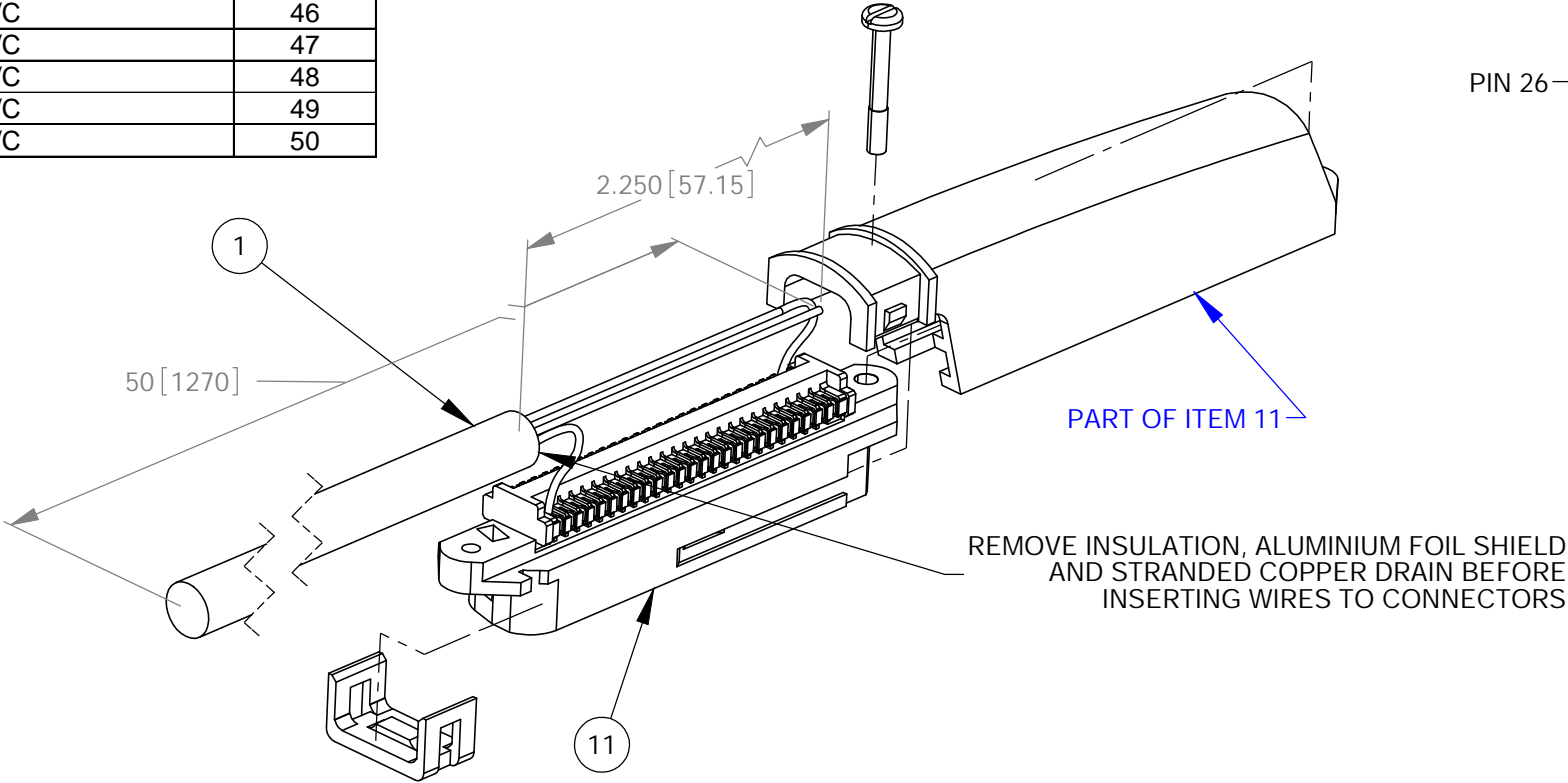
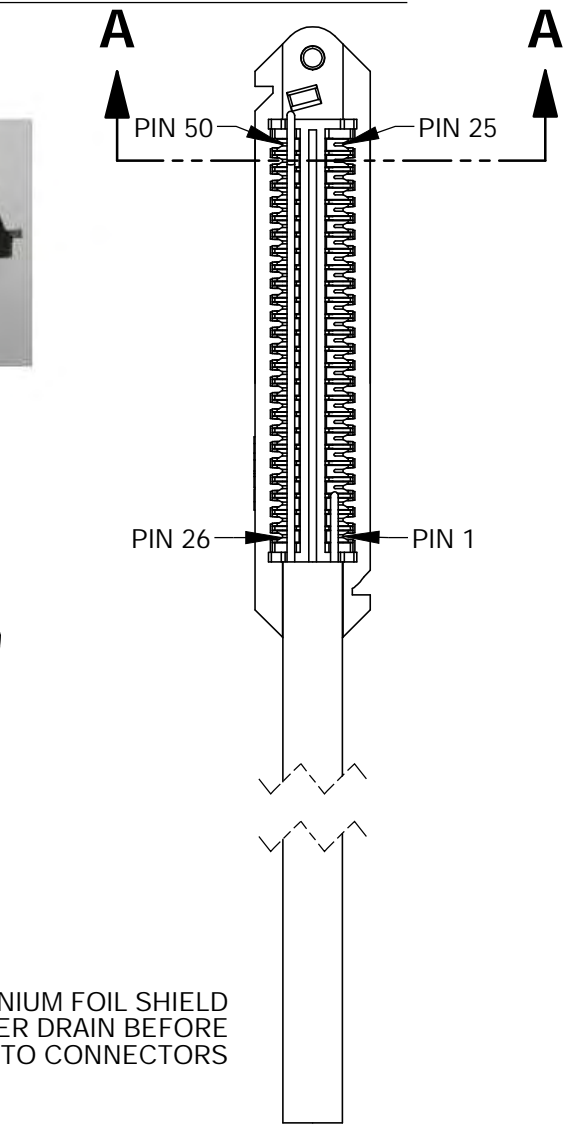
WIRES CONNECTION CHART

Wires to Connector			
Wires	Pin #	Wires	Pin #
Black/Red/Green	1	Red/Black/White	26
Black/White/Red	2	Red/Black/Green	27
Black/White/Orange	3	Red/White/Green	28
Black/White/Green	4	Orange/Black/White	29
Green/Black/White	5	Orange/Black/Green	30
Green/Black/Orange	6	Orange/White/Blue	31
White/Red/Orange	7	Blue/Black/White	32
White/Red/Blue	8	Blue/White/Orange	33
White/Black/Green	9	Red/Black	34
White/Black/Red	10	Red/Green	35
White/Red/Green	11	Red/White	36
Black/White	12	Orange/Red	37
Black/Red	13	Orange/Green	38
Green/Black	14	Orange/Black	39
Green/White	15	Blue/Black	40
White/Black	16	Blue/White	41
White/Red	17	Blue/Red	42
Black	18	Red	43
Green	19	Orange	44
White	20	Blue	45
N/C	21	N/C	46
N/C	22	N/C	47
N/C	23	N/C	48
N/C	24	N/C	49
N/C	25	N/C	50

AMP TOOL  
229384-1



SECTION A-A



ITEM  
QTY

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UNITS: mm [in]  
X [X.X] ±1 [±0.040]  
X.X [X.XX] ±0.5 [±0.020]  
X.XX [X.XXX] ±0.05 [±0.002]  
ANGULAR: ±0.5°

SCALE: 1 : 1

TITLE: ASSEMBLYCABLE, I/P,10  
MDL.SHELF CSM46

DESIGN	T.B	2008/02
DRAWN	W.H	2008/02
CHECKED	T.B	2008/02
APPROVED	M.C	2008/02

ISSUE DATE	SHEET 1 OF 2
SIZE B	TYPE DWG NO. 877-591-04
REV C	©12/26 ARGUS TECHNOLOGIES

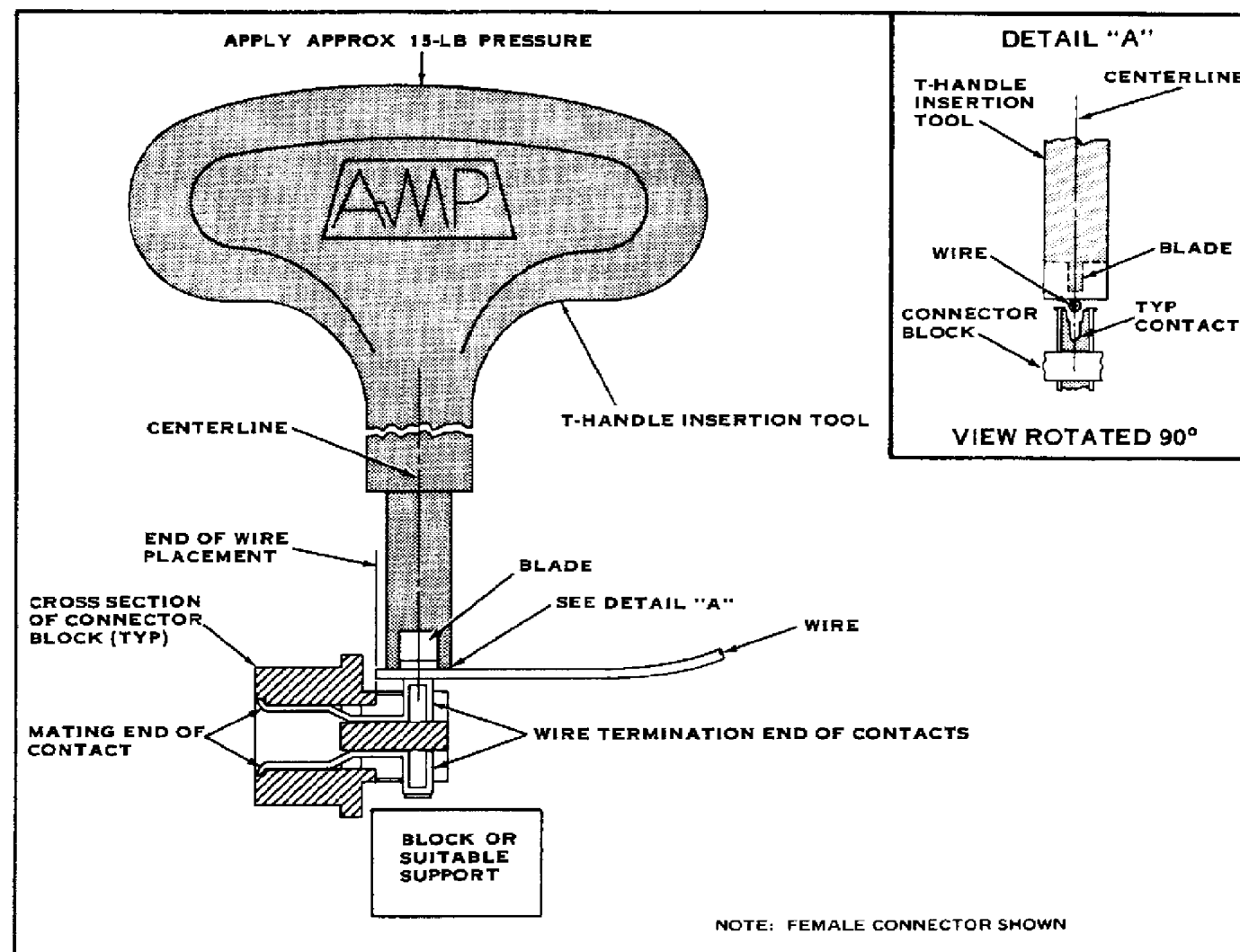


FIGURE 1

## 1. INTRODUCTION

The CHAMP T-Handle Wire Insertion Tool is used to insert individual wires into CHAMP connectors when making repairs. Carefully read these instructions before using the tool to assure a correct termination of the wire.

## 2. USE OF TOOL (See Figure 1)

- Place side of connector block, opposite the side in which wire is to be inserted, on a flat block or suitable support as shown. This is to prevent connector block from rocking or rolling.
- Position wire over contact in which wire is to be inserted. End of wire **MUST NOT** extend over

shoulder in connector block. Start wire into contact with finger.

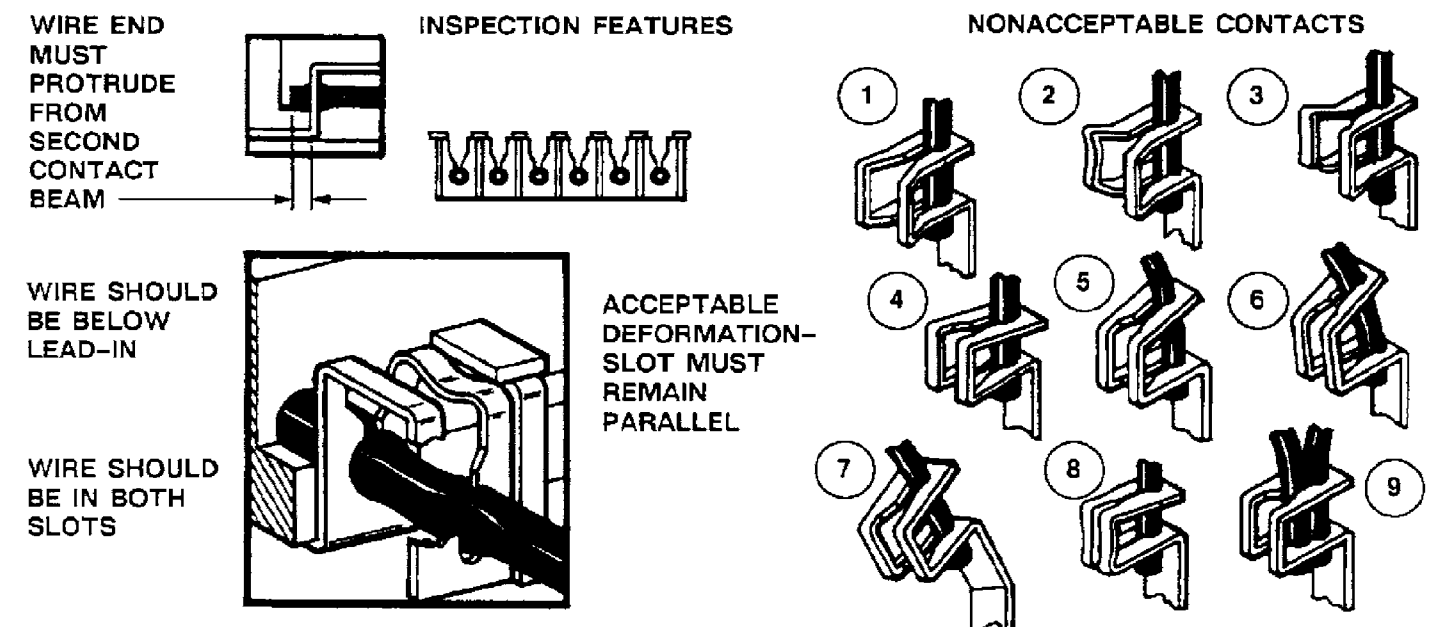
c. Place tool on wire over contact so centerline of tool matches that of contact when viewed from either direction.

d. Apply approximately 15-lb pressure **STRAIGHT DOWN** on handle. Damage could occur to the contact and/or the wire if pressure is applied at an angle to the centerline.

e. Remove tool and inspect contact for proper wire insertion. If necessary, repeat operation.

## 8. VISUAL AID

Figure 9 shows typical CHAMP Cable Connectors properly terminated and properly assembled. This illustration is to be used by production personnel to visually ensure a properly applied product. Applications which are **NOT** visually correct should be dimensionally inspected using the information given in the main body of this specification.



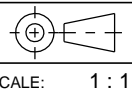
The following conditions constitute nonacceptable terminations, and the contact should be removed and replaced.

- Shoulders are bent and not parallel.
- Shoulders are bent, bowed, and not parallel.
- Contact is broken.
- Strain relief slot is bent inward.
- Strain relief slot is bent outward.
- Strain relief slot is bent outward and contact slot is bent inward.
- Contact is loose and bent.
- Contact is crushed.
- Two wires are in the same slot.

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UNITS: mm [in]  
X [X.X] ±1 [±0.040]  
X.X [X.XX] ±0.5 [±0.020]  
X.XX [X.XXX] ±0.05 [±0.002]  
ANGULAR: ±0.5°



SCALE: 1 : 1

TITLE: ASSEMBLYCABLE, I/P,10  
MDL.SHELF CSM46

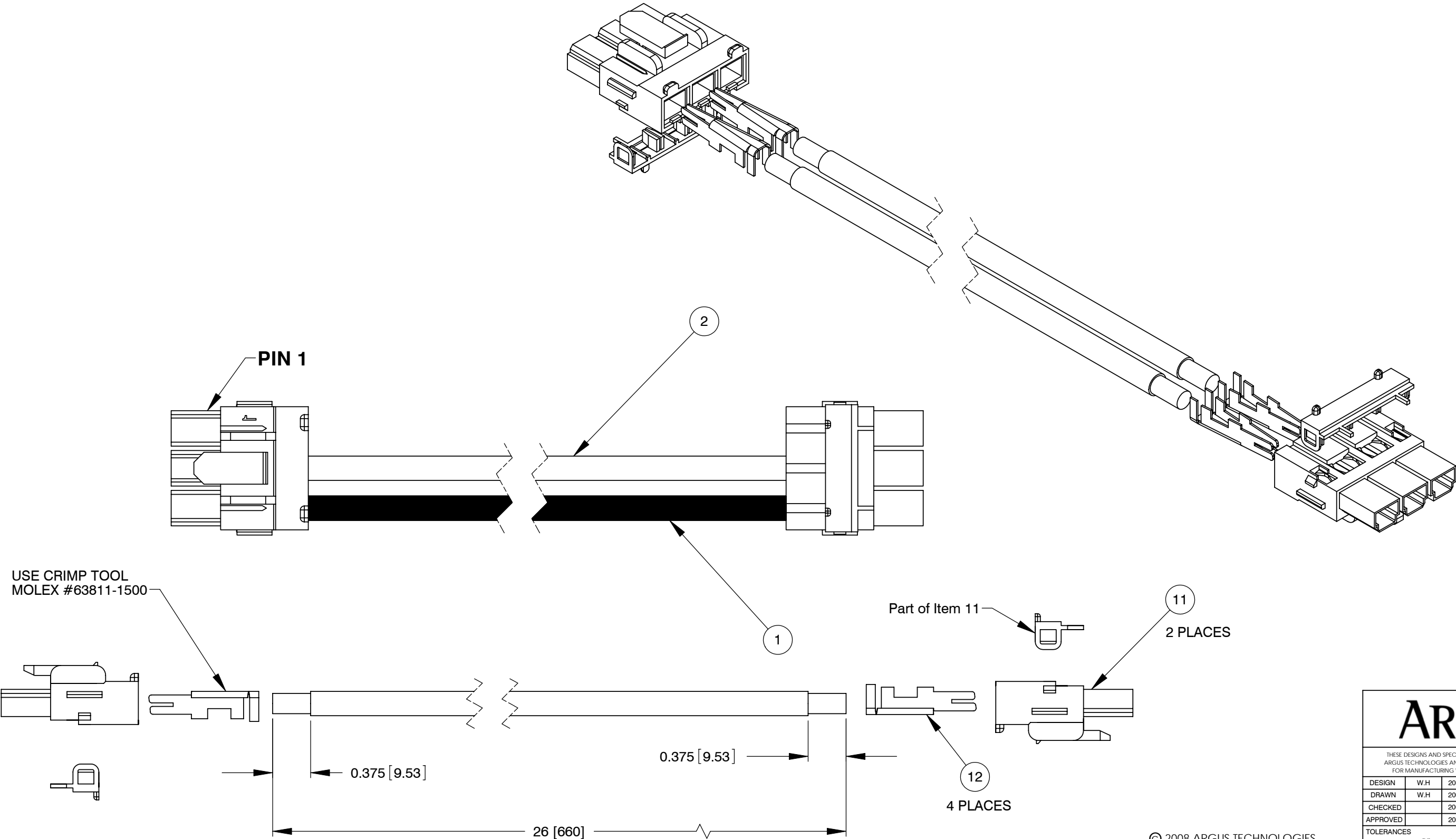
ISSUE DATE SHEET 2 OF 2

SIZE TYPE DWG NO. REV  
B D2 877-591-04 C

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REVISIONS				
LTR	DESCRIPTION	REV BY	DATE	APPD
B	REVISED TO MATCH ROHS BOM	JLM	08/04	RD



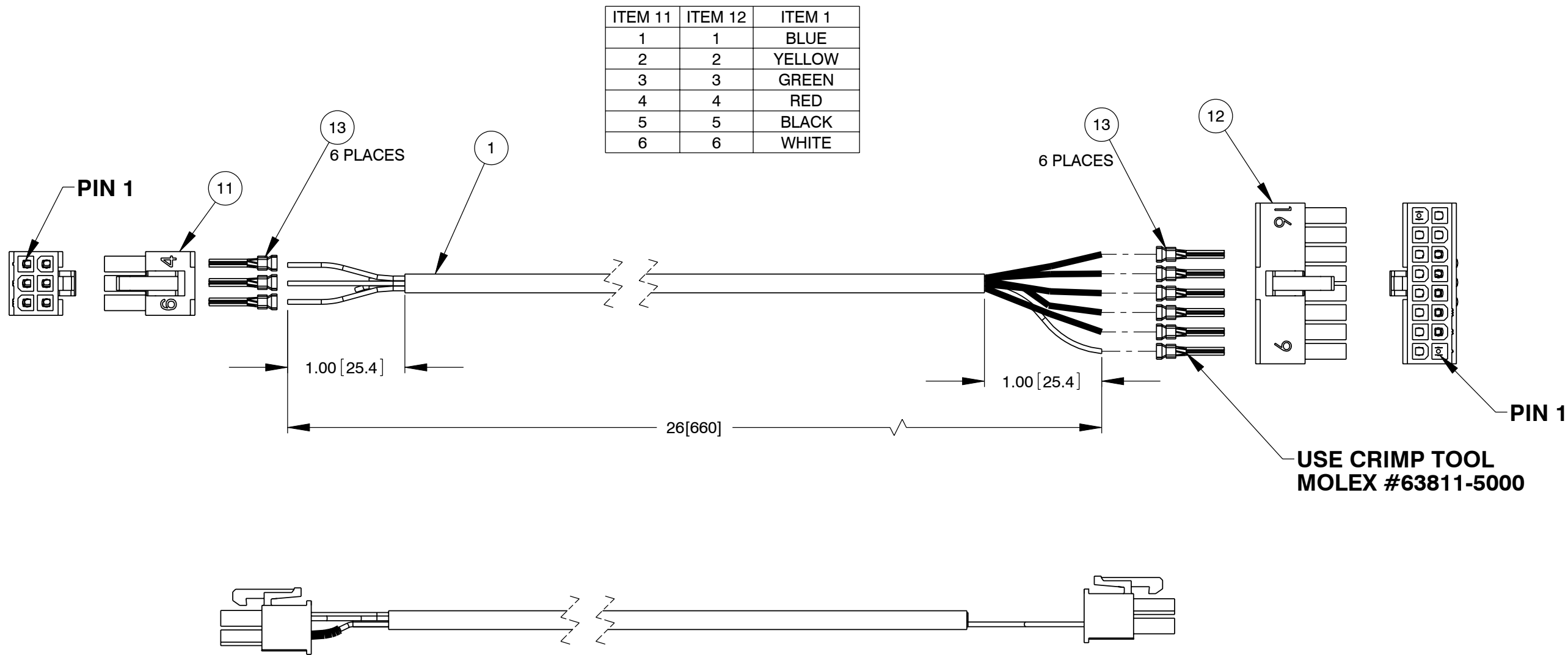
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PART IDENTIFICATION			
This part must be identified in accordance with Argus document #071-014-10 by:			
STAMPING PART	TAGGING BOX	PEN	LABELING PART
			X

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THESE DESIGNS AND SPECIFICATIONS ARE THE PROPERTY OF ARGUS TECHNOLOGIES AND SHALL NOT BE COPIED OR USED FOR MANUFACTURING WITHOUT ITS WRITTEN CONSENT.			
DESIGN	W.H	2008/01	MATERIAL
DRAWN	W.H	2008/01	SEE B.O.M.
CHECKED		2008/01	
APPROVED		2008/01	
TOLERANCES			FINISH
X.X	±0.04"	[X] ±1mm	PER P.O. and Doc. 070-024-83
X.XX	±0.02"	[X.X] ±0.5mm	
X.XXX	±0.01"	[X.XX] ±0.25mm	
			SCALE N.T.S
TITLE			
ASSEMBLY,CABLE O/P 10 MDL SHELF CSM46			
ISSUE DATE		SHEET 1 OF 1	
SIZE	TYPE	DWG NO.	
B	D2	877-593-04	
		REV B	

DIMENSIONS ARE IN INCHES WITH METRIC (mm) IN BRACKETS: INCHES [mm]

REVISIONS				
LTR	DESCRIPTION	REV BY	DATE	APPD
B	REVISED TO MATCH ROHS BOM	JLM	08/04	RD



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PART IDENTIFICATION			
This part must be identified in accordance with Argus document #071-014-10 by:			
STAMPING PART	TAGGING BOX	PEN	LABELING PART
			X

DIMENSIONS ARE IN INCHES WITH METRIC (mm) IN BRACKETS: INCHES [mm]

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DESIGN	W.H	2008/01	MATERIAL
DRAWN	W.H	2008/01	SEE B.O.M.
CHECKED		2008/01	
APPROVED		2008/01	FINISH
TOLERANCES			PER P.O. and Doc. 070-024-83
X.X	±0.04"	[X]	±1mm
X.XX	±0.02"	[X.X]	±0.5mm
X.XXX	±0.01"	[X.XX]	±0.25mm
			SCALE N.T.S

TITLE

ASSEMBLY, CABLE, ALARM  
10 MDL. SHELF CSM46

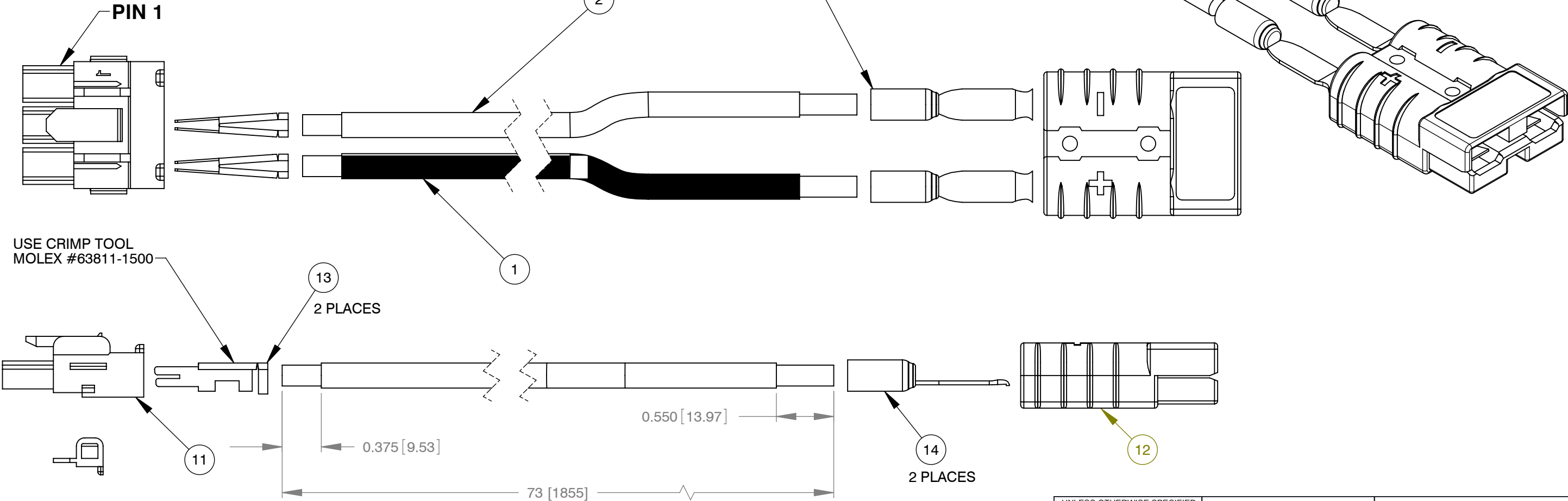
ISSUE DATE	SHEET 1 OF 1
SIZE TYPE DWG NO.	REV
B D2 877-594-04	B

DO NOT SCALE DRAWING

REVISIONS				
LTR	DESCRIPTION	DWN	DATE	CHKD
B	CORRECTED POLARITY IT#12	MP	2008/02	GS
C	REV'D TO MATCH ROHS BOM	JLM	2008/04	GS
D	REV'D FOR INTEGRATE	JL	2014/05	KLa

Recommended Soldering Techniques

Use ROHS rosin flux solder only. Wrap cable strands.  
Melt solder into well, heat and insert stripped cable.  
Continue heating well until solder flows into wire,  
being careful not to over flow onto contact surface. Do  
not solder-dip contacts.



PART IDENTIFICATION			
THIS PART MUST BE IDENTIFIED IN ACCORDANCE WITH ARGUS DOCUMENT #071-014-10 BY:			
STAMPING PART	TAGGING BOX	PEN	LABELING PART
			X

UNLESS OTHERWISE SPECIFIED DIM ARE IN MM	
X	1
X.X	0.5
X.XX	0.25
ANGULAR:	±1°
INTERPRET DIM AND TOL PER ASME Y14.5M-1994	
THIRD ANGLE PROJECTION	

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APPROVALS	
DRAWN	WH
CHECKED	TB
DATE	
FEB-2008	
FEB-2008	
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TITLE: ASSEMBLY, CABLE O/P	
MOLEX ANDERSON CSM46	
SIZE B	DWG NO. 877-621-04
SCALE: N.T.S	REV D
SHEET	1 OF 1

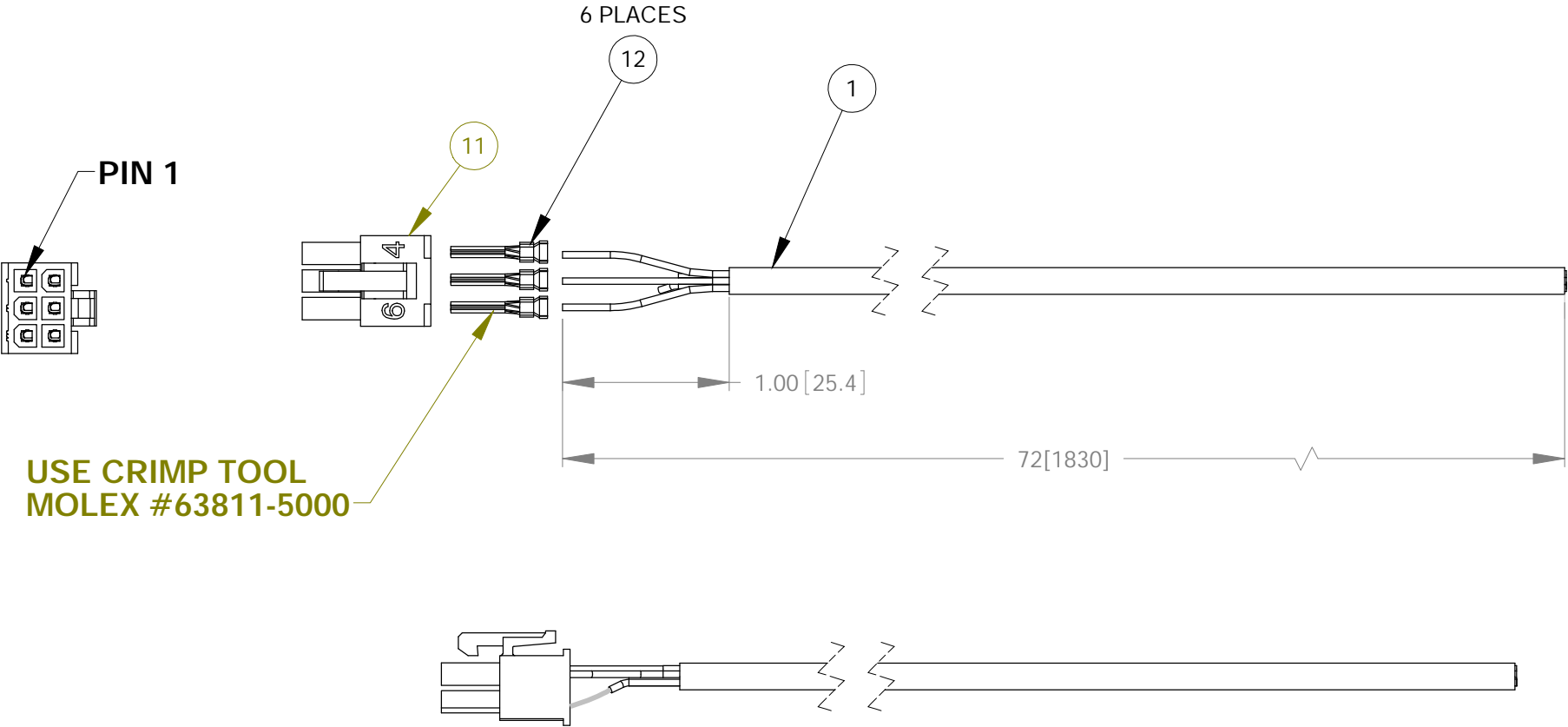
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C	CHANGED WIRE FROM SOLID TO STRANDED. CHANGED WIRE COLOR CODE.	M.P.	2009/05	MC
D	ADDED TABLE FOR 858-061-19 CABLE	M.P.	2009/07	

TABLE FOR 858-411-19 (ITEM 1)

ALARM FUNCTION		ITEM 11	ITEM 1
MINOR ALARM	NO	1	BLUE
	COMMON	2	BROWN
	NC	3	GREEN
MAJOR ALARM	NO	4	RED
	COMMON	5	BLACK
	NC	6	WHITE

TABLE FOR 858-061-19 (ITEM 1)

ALARM FUNCTION		ITEM 11	ITEM 1
MINOR ALARM	NO	1	BLUE
	COMMON	2	YELLOW
	NC	3	GREEN
MAJOR ALARM	NO	4	RED
	COMMON	5	BLACK
	NC	6	WHITE



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PART IDENTIFICATION			
This part must be identified in accordance with Argus document #071-014-10 by:			
STAMPING PART	TAGGING BOX	PEN	LABELING PART
			X

ARGUS			
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DESIGN	W.H	2008/02	MATERIAL
DRAWN	W.H	2008/02	SEE B.O.M.
CHECKED	T.B	2008/02	
APPROVED	M.C	2008/02	FINISH
TOLERANCES			PER P.O. and Doc. 070-024-83
X.X	±0.04"	[X]	±1mm
X.XX	±0.02"	[X.X]	±0.5mm
X.XXX	±0.01"	[X.XX]	±0.25mm
TITLE			SCALE N.T.S
ASSEMBLY, CABLE, ALARM O/P MOLEX/LEADS			
ISSUE DATE	SHEET 1 OF 1		REV D
SIZE TYPE DWG NO.	877-622-04		

DIMENSIONS ARE IN INCHES WITH METRIC (mm) IN BRACKETS: INCHES [mm]







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*Power*