



# CT-100

**C37.94 to T1 Converter**

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INSTRUCTION MANUAL

06.01.18

## **WARRANTY AGREEMENT**

We hereby certify that the INIVEN product line carries a warranty for any part which fails during normal operation or service for 12 years. A defective part should be returned to the factory after receiving a return material authorization number (RMA), shipping charges prepaid, for repair f.o.b. Somerville, New Jersey. In case INIVEN cannot promptly return the unit to you, it will endeavor to provide a loaner until the repair or replacement is returned to you. Any unauthorized repairs or modifications will void the warranty. In the case of parts not being commercially available, INIVEN reserves the right to replace the unit with a functionally equivalent unit.



**5 Columbia Road, Somerville, NJ 08876**

# SAFETY

**Standard safety precautions must be followed at all times when installing, operating, servicing and repairing this equipment. INIVEN assumes no liability for failure to observe safety requirements or to operate this equipment for purposes other than intended.**

## **GROUNDING**

A suitable ground is required to reduce the hazard of shock. Refer to the enclosed module, chassis, and/or cabinet wiring diagram for ground connection locations.

## **ENVIRONMENT**

Operation of any electrical equipment in area containing gases or moisture is a potential safety hazard. Necessary precautions should be taken.

## **MANUAL**

Operators and maintenance personnel should read this manual before installing the equipment and placing it in service. Only properly trained personnel with proper tools and equipment should operate, maintain, repair or service this equipment.

## **SHOCK**

Potentially dangerous electrical shock can occur when working on this product. Protective measures and safety procedures should be observed at all times.

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## Section 1 GENERAL



Figure 1-1. CT-100

### DESCRIPTION

The CT-100 is a device that converts and combines up to four IEEE Std C37.94 fiber optic interfaces into a single T1 electrical interface.

The CT-100 is designed to multiplex up to four C37.94 channels without the need to program or map the channels in the T1 frame. The physical ports on the CT-100 correspond directly with the I/O's on both ends of the T1 channel. A C37.94 channel connected to port 1 of the CT-100 will be mapped to port 1 of the corresponding CT-100 on the remote end of the T1 channel. Port 2 will be mapped to the remote unit's port 2, and so on.

The CT-100 is designed to communicate point to point over a third party electrical T1 channel, such as a leased T1 channel from a phone company. The master clock will be sourced from the T1 channel, and the CT-100 will act transparently in the communications path.

The CT-100 will support any type of C37.94 format, including multimode and singlemode fiber optic communications, depending on the type of heads specified by the customer.

The CT-100 was designed for applications such as protective relaying and other environments where substation hardened equipment is required.

The CT-100 has limited programmability. It has been designed as a plug-and-play system. Programming is limited to turning off unused channels via DIP switches. Additional DIP switches are available for future options and requirements. Communications are transparent regardless of the brand of communications equipment used. Only microseconds of delay are added to the signal propagation time.

Monitoring of both the T1 and C37.94 signals is a standard capability. The CT-100 displays the status of the channels using LED's on the front panel and relays for remote monitoring.

The enclosure is an 8.47 inch wide, 1 Unit high (1U) chassis by 9.2 inches deep. Several hardware packages are available. The chassis may be mounted in a standard 19 inch rack by itself or connected to another CT-100 or AC-20. The unit may also be panel mounted or placed on a shelf with rubber feet.

All indicators and DIP switches are located on the front of the chassis. All wiring, including communications, power, and alarm connections are on the rear of the chassis.

## **FEATURES**

**DESIGN:** The CT-100 has been designed for ease of setup and use. Each chassis can be configured for multiple mounting options and can be easily be changed in the future. Each CT-100 can be equipped with two or four C37.94 channels. These may be multimode, singlemode, or both (2 multimode and 2 singlemode). The unit's design allows for quick system monitoring and diagnosis. The use of modular piggy back fiber optic communication module, allows two C37.94 channels to be added, changed, or replaced in the field. The primary two C37.94 channels are located on the main assembly board. Removable terminal blocks allow for the CT-100 to be replaced without needing to rewire the terminations.

**PROGRAMMABILITY:** Programming is performed using the 10 position DIP switch located on the front panel of the unit. This currently is limited to turning any of the four C37.94 channels Off. This is to prevent unwanted alarms. The other 6 positions of the switch are reserved for future options that may be required by customers. The unit is designed to be plug-and-play. Iniven can modify any of the T1 settings at the factory to accommodate the local T1 requirements.

**COMMUNICATIONS:** The CT-100 converts an electrical T1 circuit to, up to, four C37.94 channels. The CT-100 is not a T1, but rather a converter. A T1 channel needs to be in place for the unit to communicate. Typically, this would consist of a leased T1 channel from a local telephone company. The T1 interface is an RJ-48 female connector. The standard CT-100 uses the T1 line format, B8ZS and the T1 frame format, ESF. Iniven can modify any aspect of the T1 formats at the factory.

The CT-100 can be equipped with either two or four C37.94 channels. Channels 1 and 2 are on the main assembly board. These can be multimode (850nm) or singlemode (1310nm) LEDs. A piggy back board is available to add channels 3 and 4. These may also be multimode or singlemode. Channels 1 and 2 need to be the same type as each other, single or multi mode; the same for channels 3 and 4. Channels 1 and 2 do not need to be the same as channels 3 and 4. Channel delay is measured in microseconds. The CT-100 does not utilize the IEEE C37.94 Yellow alarm.

All communication connections are located on the rear of the chassis.

**POWER SUPPLIES:** The power supply supports DC Input power from 24VDC to 125VDC. 250VDC input power supplies are available as an option.

**SUBSTATION HARDENED:** The CT-100 meets all requirements of IEEE Standard 1613, class 2. Environment temperatures can range from -20 degrees C to +65 degrees C.

DIAGNOSTICS: Eleven front panel LED's are used to indicate the health of the communications channel. There is a Master Alarm and Latch Alarm for the T1. There are green LED's for each C37.94 channel indicating a healthy channel and a red LED for each indicating a problem with the channel. There is also a Master Power LED and a reset switch for the T1 Latch Alarm.

ROUTING: The CT-100 uses a very basic physical routing method. Any IED connected to C37.94 channel 1 on the local unit will be output on C37.94 channel 1 on the remote unit. No additional programming or mapping is required.

The CT-100 is designed to work point to point over a T1 channel. It was not designed to work with more than a pair of units communicating over a T1 channel.

A CT-100 is required at both ends of the T1 circuit.

## Section 2 ORDERING INFORMATION

Ordering the CT-100 requires a few basic choices:

There are two power supply choices: the wide range 24-125 VDC power supply or the single voltage 250VDC power supply.

The CT-100 can be mounted several ways and should be ordered accordingly. The unit may be mounted in a 19" rack, occupying a single rack unit (1U). If a single unit will be rack mounted, the unit will come with one long and one short bracket and the corresponding screws. If two units are going to be rack mounted together, the dual hardware kit includes 2 short brackets, the interconnecting brackets to connect two CT-100's together and the corresponding screws. If the unit is to be mounted to a panel, Two short brackets and screws are included. The brackets are turned 90 degrees to fasten the unit to the panel. Sheet metal screws are not included. If the CT-100 will be placed on a shelf, rubber feet are included. No other mounting hardware are included in this configuration. If All Options are selected, the unit comes with two short brackets, the interconnecting brackets, one long bracket, rubber feet, and the corresponding screws.

If None is selected, the unit comes with no mounting hardware. The CT-100 is ordered on a per unit basis. If two units are intended to be connected together and installed in a 19" rack, one unit should be ordered with the Dual Rack hardware and one unit with None. Otherwise, there will be extra mounting hardware included with the second unit.

Two or four C37.94 channels may be installed. Each pair may be Multimode or Singlemode. The options are: two Multimode, two Singlemode, two of each, or four of one type or the other.

A set of ferrules may be added. Other options, that are customer specific, will be assigned on an as-needed basis.

See Figure 2-1, CT-100 Part Generator, to construct the proper part number.



# CT-100 PART GENERATOR

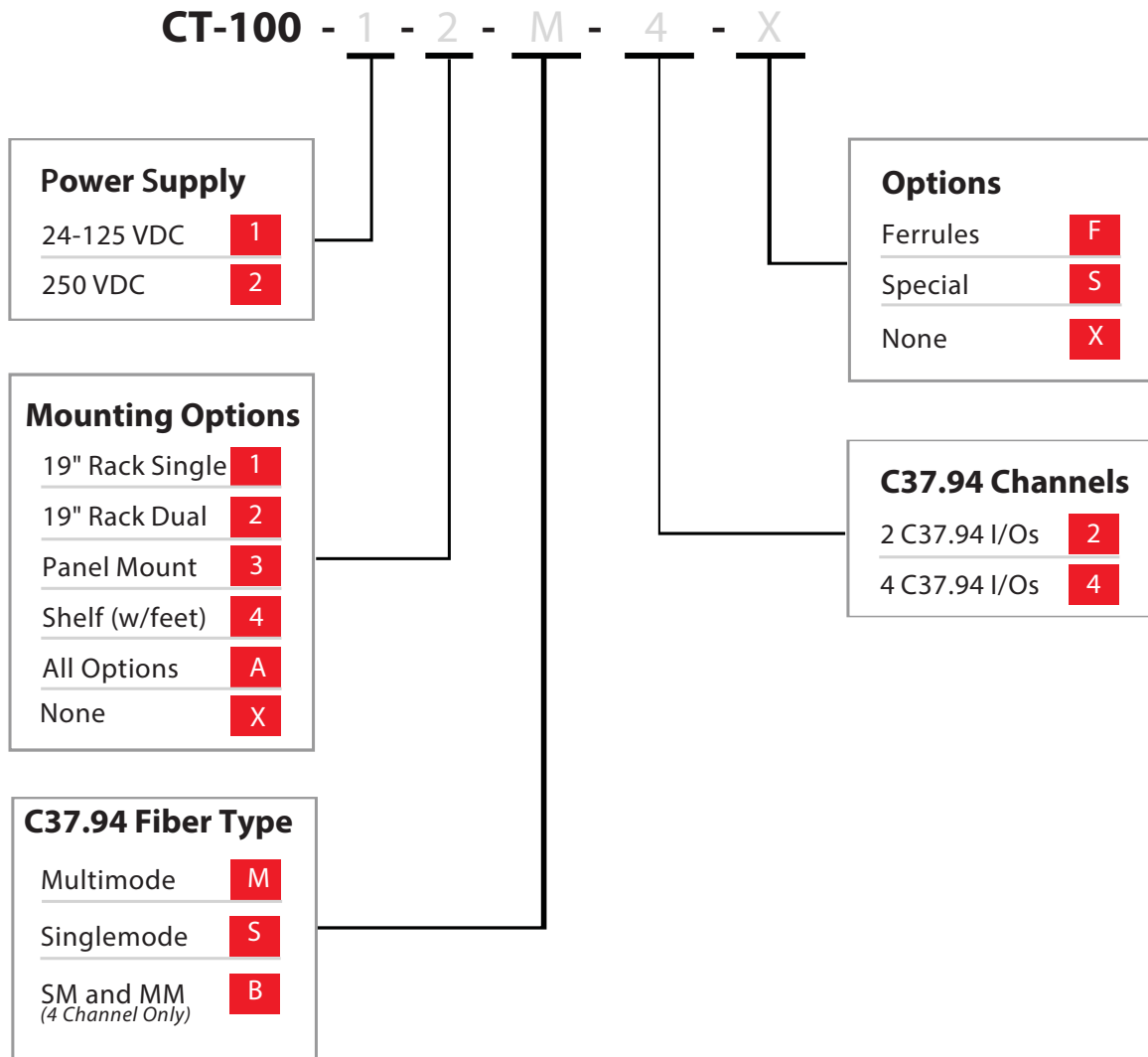


Figure 2-1. CT-100 Part Generator

## Section 3 INSTALLATION

This section of the user manual covers unpacking, mounting, initial startup module installation, and module interconnect wiring instructions.

### UNPACKING

Various forms of the CT-100 may be supplied. The unit may be supplied as an individual module, individual chassis, stacked interconnected chassis, or mounted in a rack or cabinet. Follow the procedure for the type of system supplied.

#### INDIVIDUAL MODULE OR CHASSIS

An individual chassis will be packed in its own shipping carton. Inspect the carton for possible damage in transit. Open each carton carefully and remove the chassis. Inspect the equipment for possible damage. Verify all items of value have been removed from the carton prior to discarding the packing material.

**NOTE:** It is suggested the carton be retained for possible onward shipment.

#### INTERCONNECTED CHASSIS

An interconnected chassis or equipment mounted in racks or cabinets will be shipped either in special boxes (wood crates) or via air-ride van without any case. Inspect the crate or other packaging for possible damage in transit. Carefully remove the equipment from the container and inspect it for damage. Verify all items of value have been removed from the crate prior to discarding any packaging material and refer to the above note.

Should transit damage be found, please notify Iniven immediately.

### MOUNTING

#### INDIVIDUAL CHASSIS

An individual module will come with 19" rack mount hardware, panel mount hardware, or rubber feet. Some units will come with dual 19" rack mount hardware or in some cases, no hardware. For those units, please see Dual Unit.

**19" RACK:** For a 19" rack mount of a single unit, please refer to Figure 3-1, Rack Assembly. The hardware kit should include a long bracket and a short bracket and eight 632x5 machine screws. The drawing in Figure 3-1 shows the unit on the left and the long bracket on the right. This may be reversed as the hardware is universal. Hand tighten the eight screws into the brackets and then mount the assembly into the 19" rack.

Please note: hardware to attach the CT-100 assembly to a rack, are not included. Spacing of the mounting holes is compliant with EIA and DIN standards.

**PANEL MOUNT:** If connecting a unit to a panel, please refer to Figure 3-2, Panel Assembly. The hardware kit should include two short brackets and eight 632x5 machine screws. Connect the brackets facing down or up (depending the orientation desired) and hand tighten the eight screws into the brackets.

Mount the brackets to the panel.

Please note: hardware to attach the CT-100 assembly to the panel, such as machine screws, are not included.

**SHELF MOUNT:** If placing a CT-100 on a shelf, self-adhesive rubber feet should be included. Remove the rubber feet from the backing, and place them towards the corners on the bottom of the unit.

## DUAL CHASSIS

Two CT-100's may be connected together and mounted into a 19" rack. At least one of the two units will need the dual mount hardware that will include two short brackets, two interconnect brackets, sixteen 632x5 machine screws, and four 440x3 machine screws.

The second unit that will be attached, may be ordered with no hardware since all the hardware required will be included in the dual mount hardware kit. If the second CT-100 has its own mounting hardware, set it aside, it will not be needed for this application.

Refer to Figure 3-1, Rack Assembly.

Hand tighten eight of the 632x5 screws into the L brackets. One L bracket goes on the left of one CT-100 and the other L bracket goes on the right of the second unit. Use the remaining eight 632x5 screws to attach the interconnecting C brackets to the units. One of the C brackets is slightly larger than the other; it does not matter which C bracket goes on which unit. Carefully, but firmly, slide the two units together so that the smaller C bracket sits inside of the larger C bracket. It should be a tight fit. Line up the screw holes on the top and bottom of the C brackets. Hand tighten the four 440x3 screws in the top and bottom of the C brackets. The two units should be firmly attached.

Mount the assembly into the 19" rack.

Please note: hardware to attach the CT-100 assembly to a rack are not included. Spacing of the mounting holes is compliant with EIA and DIN standards.

## SYSTEMS

Systems provided in a rack or cabinet from the factory must be secured to the floor or wall as required. Mounting hardware is not supplied due to the various surfaces and mounting methods.

**CAUTION: EQUIPMENT MOUNTED IN SWING RACK TYPE CABINETS MUST BE SECURED TO THE MOUNTING SURFACE PRIOR TO OPENING THE SWING RACK TO PREVENT THE CABINET FROM FALLING.**

## INTERCONNECTED CHASSIS

Interconnected chassis or equipment will be mounted similarly to a single chassis. When shipping rails are provided, the equipment is to be placed near the desired location. Remove the screws holding the shipping rails and remove them. Slide the equipment into the rack or cabinet, and secure it with the proper screws for mating hardware being used. Tighten all screws.

**NOTE:** Adequate ventilation is required for reliable operation of electronic equipment. Temperatures in the equipment room should be kept within specifications to assure reliable operation.

## TERMINAL BLOCKS

The CT-100 uses Euro style compression terminal blocks. The terminal blocks are two-piece units. The screw portion of the terminal block is removable. The three position Power Supply I/O uses two captive end screws to attach the two halves of the terminal block together. Remove the screws before trying to separate the terminal block. The six position Relay Alarm I/O has plastic clips that automatically grab the half of the terminal block that is permanently mounted. The terminal block will not separate easily, the use of a small screwdriver may be helpful.

The terminal blocks will accommodate wire sizes from 12-28 AWG.

## INITIAL START UP

Each CT-100 is checked and burned in at the factory. It is suggested that the CT-100 be connected and programmed on a test network before connection to an operational network in case of damage due to shipping and to ensure all programming has been done properly.

## BASIC ELECTRICAL AND FIBER OPTIC CONNECTIONS

User connections are made on the rear of the chassis through two removable, two-piece, terminal blocks and fiber optic ST ports. Refer to the Wiring Diagram in this section for specific wiring details.

The rear panel is silkscreened to match the Wiring Diagram. The silkscreen shows correct wiring and communication connections.

**CAUTION: FOR SAFETY REASONS, ELECTRICAL POWER ON THE LEADS BEING CONNECTED TO THE UNITS SHOULD BE DE-ENERGIZED DURING INSTALLATION.**

Various methods of making the connections to the terminal block may be used and are based on local practice. Make sure to tighten all connections and ensure exposed wires do not touch each other or the chassis.

To reduce the possibility of induced currents on the input leads, it is recommended that shielded twisted pair wires are used with the shield grounded at the CT-100 end only. It is recommended that the mounting rack be grounded.

**GROUNDING THE EQUIPMENT IS IMPORTANT FOR BOTH SAFETY REASONS AND RELIABLE OPERATION.** Connect a 16 AWG or larger wire between chassis ground and earth ground utilizing the shortest path to keep resistance and inductance to a minimum. It is also recommended that the rack be grounded when possible.

## BATTERY SUPPLY

The CT-100 comes equipped with one wide range (24-125VDC) or an optional 250VDC Power Supply module. Verify the battery voltage matches the voltage of the individual DC-DC converter.

Note the CT-100 has no Main Power Switch. Turn the unit ON either by installing an external switch or applying voltage to the Power In circuit. The unit must be disconnected from the DC supply before removing the unit from the rack or disassembling in any way.

## STATUS RELAY CONNECTIONS

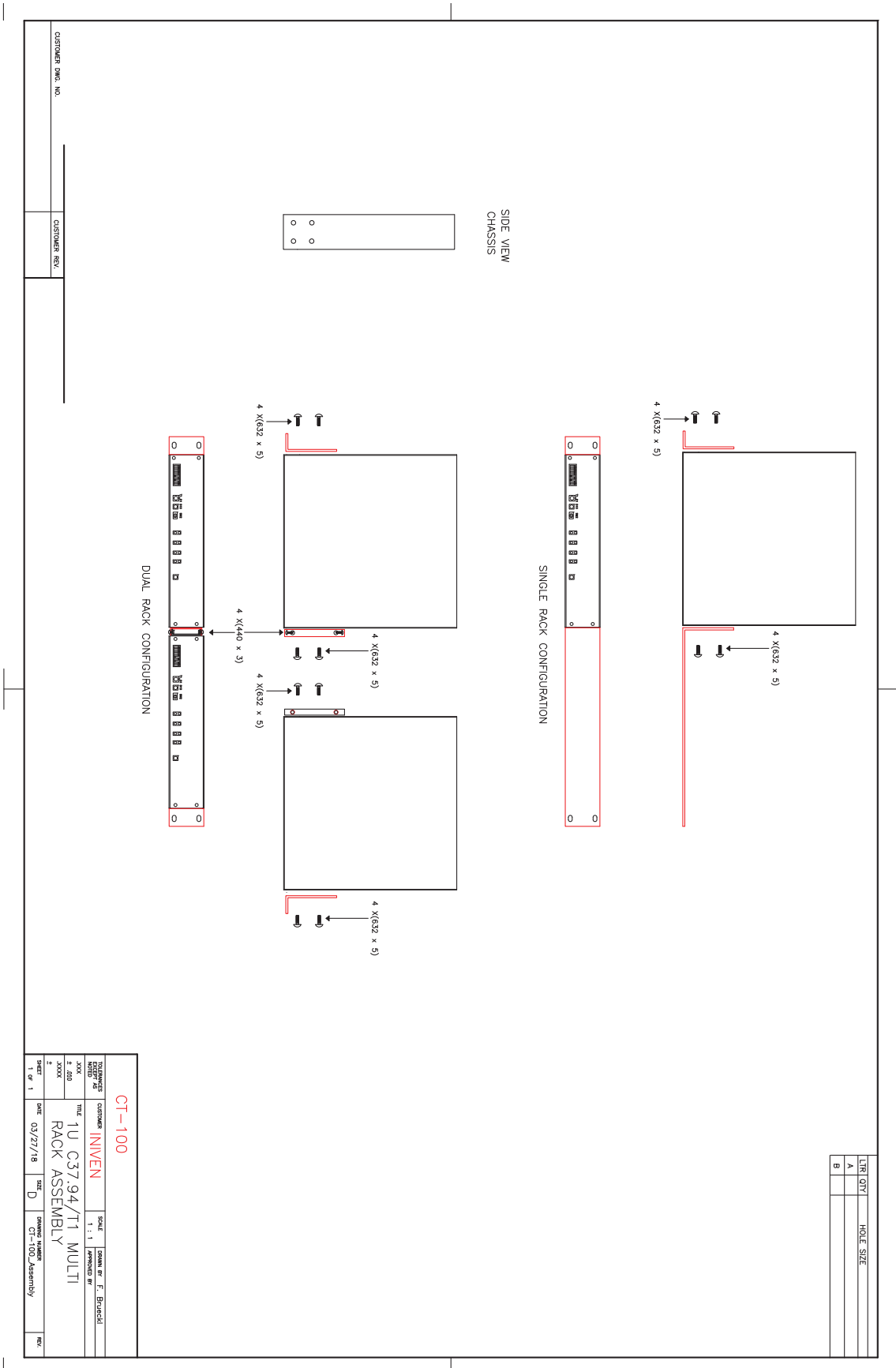
Each CT-100 has 2 relay contact terminals for status signaling to outside equipment. Each relay is a form C configuration. Either normally open (Form A) or normally closed (Form B). The type of relay function can be selected by using either NO or NC terminal for that status relay. The third terminal for each status relay is marked A, for armature. This terminal along with the NO or NC terminal determines the function of the status relay output.

The relays' coils are activated by the CT-100 circuit. The Power Fail relay's coil is activated when the power is on. The Communication Fail relay is energized when the unit is powered on and no alarm condition has occurred. For both status alarms, the alarm condition is NC.

The DC voltage wired to the terminal blocks must be supplied by an outside source. The CT-100 is not designed to supply the power for anything other than its internal circuits and communications.

There is no polarity on the wiring for alarm relays.

**WARNING: DOUBLE-CHECK ALL CONNECTIONS FOR TIGHTNESS AND CORRECTNESS, INCLUDING POLARITY AS APPLICABLE. REPLACE ALL PROTECTIVE COVERS, IF SUPPLIED.**



LTR	QTY	HOLE SIZE
A		
B		

**CT-100**

TOLERANCES UNLESS NOTED OTHERWISE	CUSTOMER	SCALE	DRAWN BY	DATE
XXX	INVEN	1 : 1	E. Brouil	
2 XXX	TITLE		APPROVED BY	
2 XXX	1U C37.94/T1 MULTI RACK ASSEMBLY			
SHEET 1 OF 1	DATE 02/27/18	SIZE D	DRAWING NUMBER CT-100_Assembly	REV

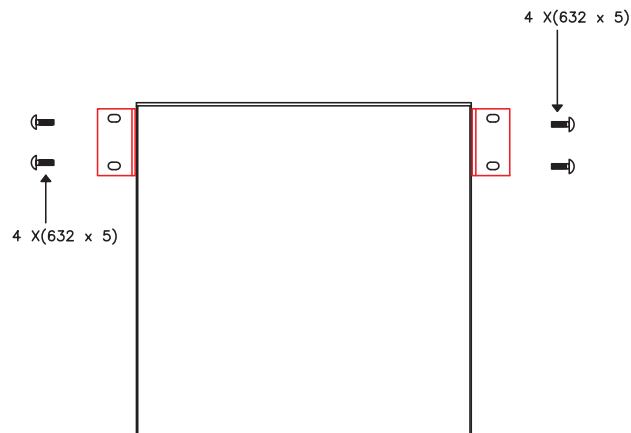
Figure 3-1. Rack Assembly

LTR	QTY	HOLE SIZE
A		
B		

PANEL



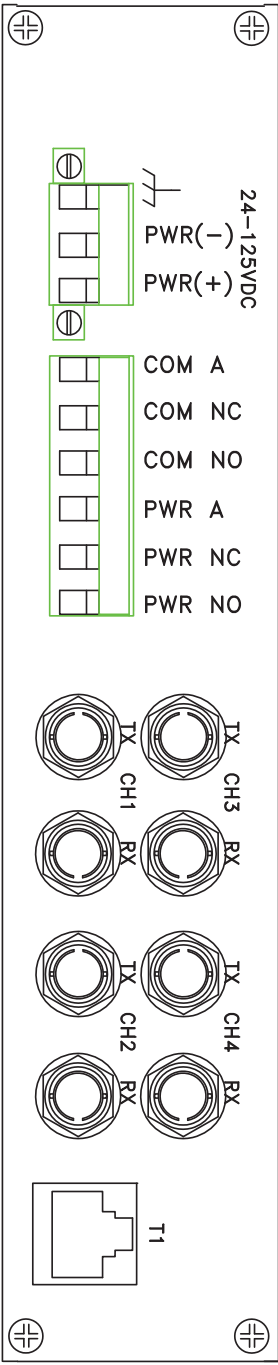
SINGLE RACK CONFIGURATION



CT-100			
TOLERANCES EXCEPT AS NOTED	CUSTOMER <b>INIVEN</b>	SCALE 1 : 1	DRAWN BY F. Brueckl APPROVED BY
.XXX ± .010	TITLE 1U C37.94/T1 MULTI WALL MOUNT		
.XXXX ±			
SHEET 1 OF 1	DATE 03/27/18	SIZE D	DRAWING NUMBER CT-100_Assembly_wallMT
			REV.

Figure 3-2. Panel Assembly

REVISIONS			
SYM	DESCRIPTION	DATE	BY



MATERIAL	ALUMINUM .098 THK	DRAWN BY	FB	DATE	10/12/17	<b>INIVEN™</b> SOMERVILLE, N.J. 08876
FINISH	CLEAR IRIDIUM	CHECKED BY				
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES TOLERANCES ARE: XX = ±.020 XXX = ±.010 HOLE DIA. = ±.002 ANGLE = ±5°		SCALE:	B	FSM NO.	32840	REAR DIAGRAM
DO NOT SCALE DRAWING		SCALE:	B	DRIVING NO.	REAR DIAGRAM	REV. B

Figure 3-3. CT-100 Wiring Diagram



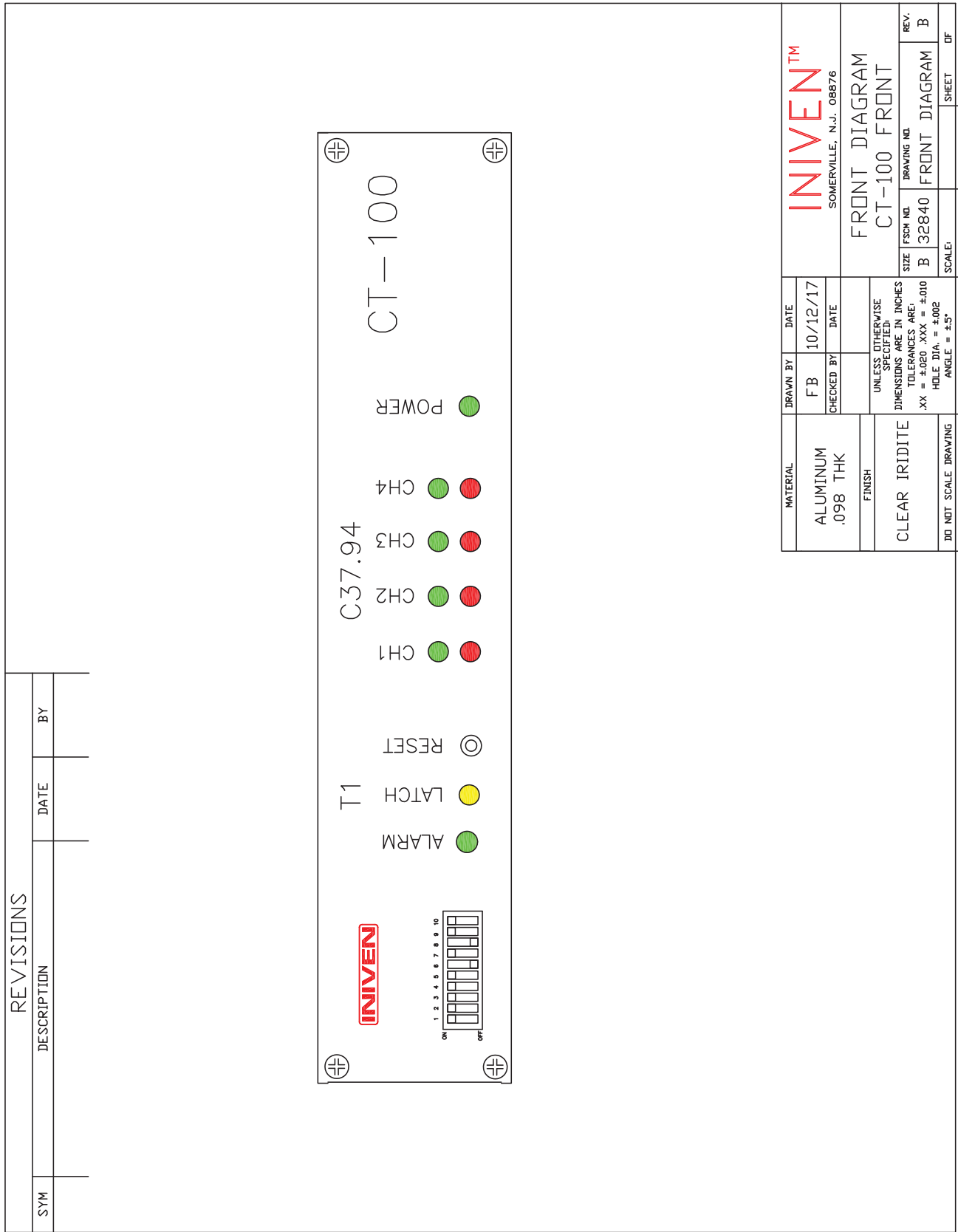


Figure 3-4. CT-100 Front Panel

## Section 4 PROGRAMMING

### INITIAL CT-100 PROGRAMMING

#### DIP SWITCH SETTINGS

CT-100 programming is very simple. There is a 10 position DIP switch on the front panel. Switch position 1 - 4 are used to turn On/Off the four C37.94 channels. Switch 1 controls channel 1, switch 2 controls channel 2, and so on.

- 1) Switch 1 in the up position enables C37.94 XMT1 and RCV1. Down disables the channel.
- 2) Switch 2 in the up position enables C37.94 XMT2 and RCV2. Down disables the channel.
- 3) Switch 3 in the up position enables C37.94 XMT3 and RCV3. Down disables the channel.
- 4) Switch 4 in the up position enables C37.94 XMT4 and RCV4. Down disables the channel.

This version of the CT-100 does not have any other programmability and is designed to be plug and play.

All T1 circuits may not operate the same way. The communications processor used in the CT-100 is capable of supporting all T1 options. Any changes to the T1 settings need to be made by the factory. The six unused DIP switches are reserved for future settings options for T1 communications or other customer requirements.

Please contact Iniven if there are questions or requirements not supported by this version of the CT-100.

**ANY CHANGES MADE TO THE DIP SWITCHES ARE INSTANTANEOUS.**

## Section 5 ASSEMBLY

### GENERAL

The Basic Assembly complies with EIA dimensional standards and, when rack mounted, occupies one rack unit (1.875 inches) of vertical space in a 19-inch rack or cabinet. Its overall dimensions are as follows:

Height: 1.72 inches (43.69 mm) Width 19 inches (483 mm) Depth: 9.2 inches (233.68 mm)

One or two CT-100's can fit in a 19" 1U rack space. Each module is completely independent and only shares the physical rack space. When a single unit is placed in a 19" rack, it may occupy either the right or left side of the space. All mounting hardware is designed to be universal, without being a right or left, or up or down. Terminal blocks, the T1 connector, and fiber heads are located on the back of the chassis. Wiring is completed using a removable euro-style terminal block. After wiring the terminal block, two end screws secure the block to the chassis.

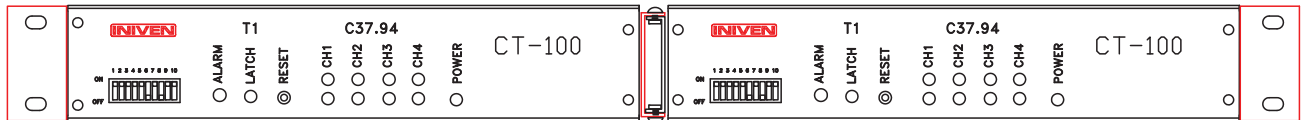


Figure 5-1. Dual Front Panel

### FRONT PANEL LEDs

The front panel contains eight C37.94 LEDs, two for each channel. A green LED indicates communication is detected over the channel. A red LED indicates that the channel is on but no communication is detected. If neither LED is on, the channel has been turned off by the DIP switch on the front of the CT-100.

There are two T1 Fail indicators and a reset switch located on the front panel. If a loss of communications is detected on the T1 channel, the T1 ALARM multi-colored LED on the front panel will turn red. When the T1 ALARM LED is green, the T1 channel is communicating properly. A T1 is considered in alarm when any of the 4 following conditions exist:

- Receive Remote Alarm Indication Condition (RRAI). Set when a remote alarm is received at RTIP and RRING.
- Receive Alarm Indication Signal Condition (RAIS). Set when an unframed all-ones code is received at RTIP and RRING.
- Receive Loss of Signal Condition (RLOS). Set when 192 consecutive zeros have been detected after the B8ZS/HDB3 decoder.
- Receive Loss of Frame Condition (RLOF). Set when the DS26521 is not synchronized to the received data stream.

When a T1 loss of communication alarm is detected, the amber LATCH alarm will illuminate. This LED will remain lit until an operator presses the RESET button. Once the latch is reset, it will remain

off until another loss of communication alarm is detected.

The Power LED remains green when the unit is powered On and is Off when the power is Off or has failed.

Power:

- Green: Power is ON.
- Off: Power is OFF.
- Slow flashing Green: Input power is too low for the rating of the DC/DC converter.

T1 Fail:

- Green: No problems detected on the T1 channel.
- Red: A Loss of Communications is detected on the T1 channel.

T1 Latch:

- Amber: The T1 Fail alarm has been keyed. The amber light will stay on until the T1 Reset button is pressed.
- Off: There has not been a T1 Fail alarm since being reset.

C37.94 (1-4):

- Green: The C37.94 channel has detected communications.
- Red: Indicates that the C37.94 channel is on but no communications are detected.
- Off: The channel has been disabled.

## STATUS ALARMS

There are two status relays integrated into the CT-100: Power Fail and Communications Fail. Each of the alarm relays are Form C relays. The terminal blocks allow for either alarm to be wired as a normally open (NO) or normally closed (NC) relay. See Section 3, Installation.

When set-up for NC, the alarm relay will be closed when there is no power to the unit and when the unit is alarming. The relay will be in the open position when the unit is energized and no alarm is present.

When set-up for NO, the alarm relay will be open when there is no power to the unit and when the unit is alarming. The relay will be in the closed position when the unit is energized and no alarm is present.

Power Fail is used to indicate that the unit's power supply can no longer operate within acceptable parameters. In the case of a power failure, all status relays will return to their "normal" position and the green Power LED on the front panel will turn off. When power is being supplied to the unit, the green Power LED will remain illuminated.

Com Fail is a common alarm shared by the, up to, four C37.94 interfaces and the T1 interface. If any of the communication channels were to stop communicating, the Com Fail relay will go to its "normal" state. This alarm will also return to normal if there is a power failure.

## Causes for Alarms

### Power Fail:

- Power has failed.
- Input power has exceeded or is too low for the rating of the DC/DC converter.
- No delay.

### Com Fail:

- A loss of communication detected on the T1 or any of the four C37.94 channels.
- A loss of packet structure (bad data) on the T1 or any of the four C37.94 channels.
- Fiber optic receive signal level below the ability of the heads to receive data accurately.
- A C37.94 channel is unused but has not been turned off using the DIP switch.
- No delay.

## POWER SUPPLY

The CT-100 comes with a standard wide range DC/DC converter, unless a 250VDC has been ordered or installed. The standard input range 24VDC -20% to 125VDC +20%. The converter is mounted to the PC board of the CT-100 with two screws. The pins connecting the electrical circuits of the DC/DC converter to the PC board are socketed and the whole converter can be removed once the mounting screws are removed.

The DC/DC converter has under and over voltage protection integrated into the device. If the input voltage is too low or too high, the status alarm LEDs may flash or the unit may attempt to restart itself.

The power supply LED on the front panel is green and illuminates when the power is on. The power supply relay can be normally closed or normally open by wiring to the appropriate terminal on the rear of the unit. See Section 3, Installation.

## INPUTS AND OUTPUTS

The rear panel contains all the I/O connections. Communications interfaces consist of one RJ 45/48 T1 plug and up to four C37.94 fiber optic interfaces. Each C37.94 interface has one transmit and one receive 850nm multimode head with an ST connector. A singlemode 1310nm LED C37.94 interface is available as an option. The CT-100 is equipped with either two or four C37.94 channels.

Two sets of removable terminal blocks, for wiring power and alarms, are located on the rear of the chassis.

The CT-100 uses a wide range power supply capable of operating on a DC voltage between 24 and 125 V. One of the two terminal blocks are dedicated for DC connections. The connections are for +, -, and ground.

The second terminal block is used to connect the two, dry contact, Form C relay alarms. The alarms are for communication fail on any of the communication channels, T1 and/or C37.94, and power fail. Each alarm has 3 connections, normally open (NO), normally closed (NC), and armature (A). The alarm relays do not have polarity and accept voltages up to 125VDC.

## Section 6 SPECIFICATIONS

### Physical:

#### Dimensions (Single):

Height: 1.72 in. (43.69 mm)  
Rack Space: 1 RU  
Width: 8.47 in. (215.14 mm)  
Depth: 9.2 in (233.68 mm)  
Weight: 10 pounds (4.5 kg) max

#### Dimensions (Dual):

Height: 1.81 in. (45.98 mm)  
Rack Space: 1 RU  
Width: 19 in. (482.6 mm)  
Depth: 9.5 in (241.3 mm)  
Weight: 10 pounds (4.5 kg) max

### Operating and Storage Temperatures:

-20 degree C to +65 degree C  
(-4 degree F to +149 degree F)  
Up to 1500 meters altitude

### Relative Humidity:

95% maximum @ +42 degree C  
(+108 degree F) non-condensing

### Interface Dielectric Strength

Surge Withstand Capability (SWC)  
FAST Transient

### Radiated EM Interference (RFI)

### Electrostatic Discharge (ESD)

Inputs, outputs & connectors  
meet the following Standards:  
IEEE Standard 1613-2003 (Class 2)

### Front Panel:

11 LEDs  
1 Push button reset switch  
T1 Com Fail latch alarm

### LEDs:

Power (Green)  
T1 Fail (Red)  
T1 Fail latch (Amber)  
4 x C37.94 Channel Fail (Red)  
4 x C37.94 Channel Good (Green)

### Alarm Relay Outputs:

Form C  
Max contact make rating, 1 amp  
Max contact voltage, 300 VDC  
Power Fail  
Com Fail

### LEDs:

Power (Green)  
T1 Fail (Red)  
T1 Fail latch (Amber)  
4 x C37.94 Channel Fail (Red)  
4 x C37.94 Channel Good (Green)

### Fiber Optics (C37.94):

Data Rate: 0 to 155Mbps  
Fiber optic types:  
850 nm MM LED  
1310 nm SM LED (optional)  
Connector type: ST  
Meets IEEE Std C37.94™-2017 optical  
requirements  
2 or 4 TX/RX pairs per unit

### T1:

Electrical T1 Compliant  
RJ-48 electric connector (female)  
T1 Line Format, B8ZS  
T1 Frame Format, ESF

Propagation Delay: 3 microseconds (est)

### Terminal Blocks:

Euro Style pressure clamp  
Power: 3 Position with captive screws  
Alarms: 6 Position  
Bare or ferrule terminated  
28-12 AWG

Power Supply:

Battery Supply Voltages:

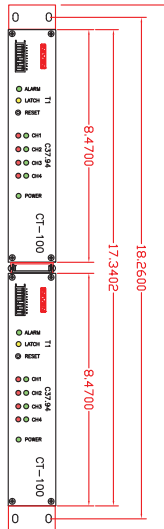
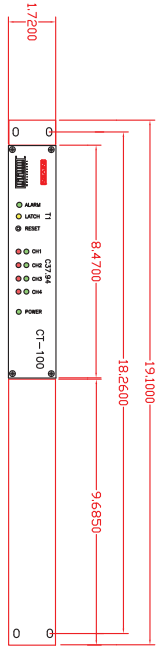
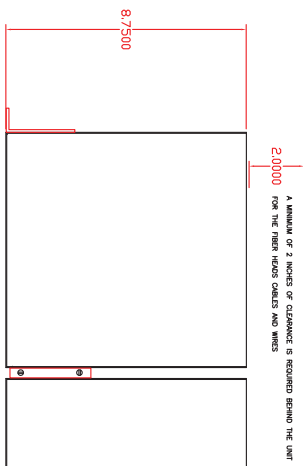
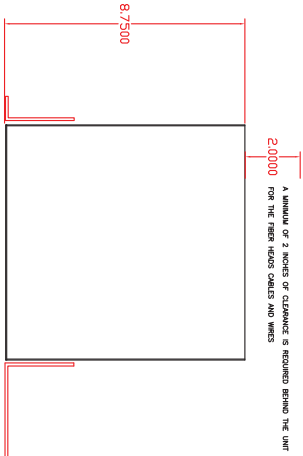
Nominal	Permissible Variation	Current Draw
24-125 VDC	19-150 VDC	150ma max
250 VDC	200-300 VDC	75ma max

DC/ DC converter output voltage: 5 VDC

Fuses (2AG):

Input (F1): 1A, 250V  
Output (F2): 3A, 250V

LT#	QTY	HOLE SIZE
A		
B		



CUSTOMER DWG. NO.		CUSTOMER REV.	
<b>CT-100</b>			
DESIGNER	CUSTOMER	SCALE	DRAWN BY
DATE	INIVEN	1:1	F. BURDICK
<b>CT-100</b>			
<b>DIMENSIONS</b>			
SHEET	DATE	SIZE	DRAWING NUMBER
1 OF 1	03/27/18	D	CT-100-Dimensions



## Section 7 MAINTENANCE

**ALL SAFETY PROCEDURES ARE TO BE STRICTLY ADHERED TO AND ONLY QUALIFIED MAINTENANCE, OPERATORS, OR SERVICE PERSONNEL ARE TO PERFORM WORK ON THIS EQUIPMENT. LIFE THREATENING VOLTAGES AND CURRENTS ARE PRESENT WITHIN THIS EQUIPMENT. OBTAIN ALL REQUIRED APPROVALS TO PLACE THIS EQUIPMENT IN OR OUT OF SERVICE.**

### PREVENTIVE MAINTENANCE

The CT-100 is designed for trouble free service. It is not necessary to perform preventive maintenance. This statement is not intended to replace preventive maintenance procedures in place within any particular organization.

**WARNING: ALWAYS TURN OFF THE POWER TO THE CT-100 BEFORE REMOVING THE UNIT.**

### POWER SUPPLY FUSE REPLACEMENT

If the CT-100 has power being applied to the terminal blocks and yet there is no green Power LED lit on the front panel, a fuse may be blown.

When replacing a failed fuse, first disconnect the CT-100 from the power source. Unscrew the Power I/O terminal block using the 2 captive screws from either end of the terminal block. Gently remove the terminal block. Then remove the Alarm I/O terminal block by pulling firmly. A small screw driver may assist, by being used to pry the two parts of the terminal block apart. It is not necessary to unwire the terminal block or remove the ground wire. If mounted in a rack, remove the mounting screws connecting the CT-100 to the rack. Gently remove the unit from the mounting rack. Remove the four screws on the cover of the chassis and the top two screws on both the faceplate and rear of the chassis. Lift the aluminum cover off. Use a flat blade screwdriver or fuse puller to move the failed fuse from the clips. Be careful not to shatter the glass. Eye protection should be worn. Replace the fuse with one of the same physical and electrical characteristics.

Replace the cover of the CT-100 using the eight screws, four on the top of the cover and the top two screws on the front and back of the unit. If the unit was mounted in a rack, place the CT-100 back in the rack and secure it with the mounting screws. Replace the terminal blocks. Secure the PS I/O terminal block using the two captive screws. Connect the power source to the CT-100. If the green Power LED is illuminated, the problem has been corrected. If the LED does not light or if the fuse blows again, further troubleshooting is required. Iniven should be contacted at (800) 526-3984 for assistance, repair or replacement of the faulty module.

### DC/DC CONVERTER REPLACEMENT

Follow the above instructions for removing and opening the CT-100. Before removing the DC/DC converter, check to make sure the fuse has not blown. Locate the DC/DC converter. This is the main power supply for the CT-100 and has a large flat aluminum top with two screws attaching it to the PC board. Remove the two screws and remove the DC/DC converter from the PC board mounted sockets.

Replace the DC/DC converter. The converter cannot be put in backward. Reuse the mounting screws and attach the converter to the PC board.

Replace the cover and reinstall the unit as described above. Connect the power source to the CT-100. If the unit continues to have DC/DC converter issues, further troubleshooting is required. Iniven should be contacted at (800) 526-3984 for assistance, repair or replacement of the faulty module.

## Section 8 GLOSSARY

### **ANSI – American National Standards Institute**

The primary organization for fostering the development of technology standards in the United States.

### **Alarm**

A signal generated when abnormal network conditions exist.

**Major Alarm** – indicates major abnormal conditions where service is disrupted or out.

**Minor Alarm** – indicates minor abnormal conditions where service is not disrupted.

**Status Alarm** – indicates information regarding the status of an action or event.

### **BER – Bit Error Rate**

The percentage of bits that have errors relative to the total number of bits received in a transmission. It is usually expressed as ten to a negative power. For example, a transmission might have a BER of 10 to the minus six, meaning that out of 1,000,000 bits transmitted, one bit was in error.

### **BPS – Bits Per Second**

A measure of speed in serial transmission, the number of binary 1s and 0s sent each second. Also uses Kbps for thousands of bits per second (bps), Mbps for millions of bits per second and Gbps for billions of bits per second.

### **Bit**

A unit of measure of information designated by a specific value (e.g., binary digit “0” or “1”).

### **Bit Rate**

The speed at which the bits are transmitted (e.g., 2400 bps).

### **Com Port – Communications Port**

A standard PC will have up to 4 communications ports but generally will only have COM1 and COM2 present as standard communications. This port can be used to connect a modem or any other communications device to the PC.

### **Channel**

In communications, a transmission path (usually both ways) between two or more points.

### **Circuit**

In communications, a means of two-way communications between two or more points; usually metallic (e.g., telephone line) or fiber-optic.

### **Connection Types**

A connection type that is either dedicated (assigning a permanent connection) or virtual (assigning a temporary connection).

### **Content**

Information carried across a given circuit, regardless of format.

### **Data**

A Digital representation of facts, concepts, or instructions.

### **Digital**

Information that has been binary encoded (a 1 or a 0).

### **DIN - Deutsches Institut für Normung**

The German institute for standardization and Germany’s ISO member body responsible for creating standards.

### **EIA – Electronic Industries Association**

A standards setting body comprised primarily of manufacturers. (See RS-232, RS-449, etc.)

### **FDDI – Fiber Distributed Data Interface**

An ANSI standard for fiber optic links with data rates up to 100 Mbps.

### **FOTS – Fiber Optic Transmission System**

An acronym to designate the optical network

### **Fiber Optics**

An optical transmission medium that consists of thin, plastic (or glass) strands which reflect light pulses within their interior along their length as a means to transmit large amounts of data.

### **IED - Intelligent Electronic Device**

A generic term used to describe devices with microprocessor controllers.

### **ISO – International Standards Organization**

International Standards Organization Group responsible for CCITT/ITU standards for digital transmission over ordinary telephone copper wire as well as over other media.

### **Kbps – Kilobits per second (one thousand bits per second)**

A measure of bandwidth (the amount of data that can flow in a given time) on a data transmission medium. Higher bandwidths are more conveniently expressed

in Megabit per second (Mbps or millions of bits per second) and in Gigabits per second (Gbps, or billions of bits per second).

### **LOS – Loss of Signal**

An alarm signal sent from the local node to a remote node indicating that no data is being received from the remote node.

### **Mbps – Megabit per second**

The measure of a data transfer rate (the total information flow over a given time) on a communication medium equal to 1,000,000 bits per second.

### **MTBF – Mean Time Between Failure**

A measure of how reliable is a hardware product or component. For most components, the measure is typically in thousands or even tens of thousands of hours between failures.

### **Megabyte**

One million bytes, but commonly used to indicate 1,048,576 bytes.

### **NC - Normally Closed**

The description of a relay in the open position when the coil is deenergized.

### **NO - Normally Open**

The description of a relay in the closed position when the coil is deenergized.

### **Optical Power Budget**

In a fiber-optic communication link, refers to the allocation of available optical power (expressed in dB) among various loss-producing mechanisms such as coupling loss, fiber attenuation, splice losses, and connector losses. This insures that adequate signal strength is available at the receiver.

### **Point-to-Point Configuration**

Communications system where channel(s) are available between only two equipment locations or nodes.

### **Port**

1. The physical connection between a device and a circuit. It's capacity determines the greatest amount of data that can be transmitted at any given time.
2. A 16-bit integer used by Internet Protocol (IP) that identifies where to deliver data. Port numbers 0-1023 are reserved for assigned applications, and 1024-65535 are available for user applications. The IP suite transfers data between hosts based on IP

addresses and distributes data to processes and applications on a host based on the port number.

### **Route**

A connection path that consists of an originating node, the node through which the route passes (transfer point), and a destination node. Routes can be defined as either primary or alternate.

### **Routing**

The process of selecting a communication path through the network.

### **Teleprotection**

A type of communication terminal equipment used by the relaying industry for sending discrete contact logic signals from point to point with a high degree of security and dependability.

### **Timing**

Refers to the source of clock signals used to synchronize the network (e.g., internal timing, external timing).