TECSYSTEMS S r. I.

INSTRUCTION MANUAL

NT538 10 Cu

P8V12-R1.0

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NT538 10 Cu
0 – 220C
Instruction Manual Jan 2007
Rev P8 V12-R1.0
E L Switchgear and Control Inc

Introduction

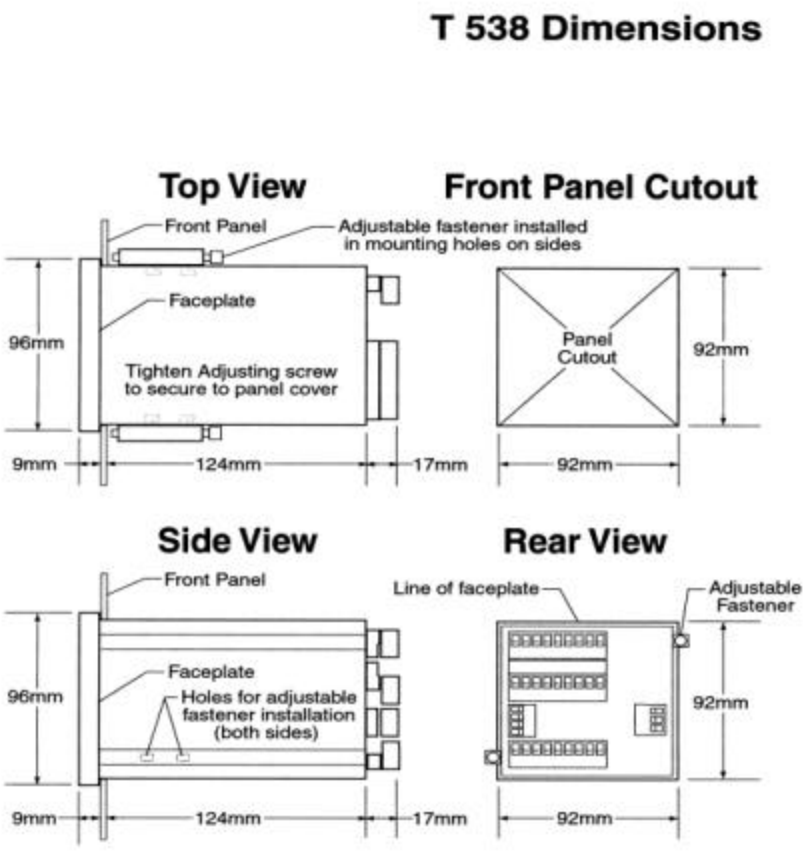
The NT538 10 CU temperature monitor will survey and control up to eight, three-wire RTD inputs. The RTD sensing range is 0°C to 220°C. Each input channel may be user programmed with individual Alarm and Trip set points in a range of 0 to 220 °C The unit is microprocessor based which offers application flexibility, and easy integration to a variety of applications including electric motors; electric and diesel generators; all types of transformers; electric cables; and industrial and chemical processes. ANSI 49 covers the thermal protection provided.
The unit is intended for semi-flush mounting with hardware provided. Installation and set-up are simple using the universal power supply 24 to 240V AC or DC and functional user controls and display.

Mounting

NT538 10 CU is designed for semi-flush panel mounting. Mounting hardware is included with each unit. The panel cutout dimension is 92 x 92mm (3.62 in. x 3.62 in.)

Dimensions
For NT538 10 CU, overall depth changes to **140mm**
96 x 96 x 140mm (3.78 x 3.78 x 5.51 in.)

Figure 1



Controls

All functional controls and displays are located on the front of the unit. The unit has six input keys, two having dual functions. These are PRG/SET and ENT/RESET. Keys may be categorized as, programming, screen display, and test.
Programming keys are located at the bottom of the unit and may be identified by the blue type. These are PRG, ENT, UP (symbol) DOWN (symbol). The screen display may be changed by the DISPLAY MODE key located to the upper right and is identified by the yellow type. The TEST key is located on the bottom between the programming keys. When the test provision is enabled the SET and RESET keys are activated, with the PRG and ENT keys disabled.

Screen Displays

Each active channel has four associated LED's; green, yellow and red. These LED's provide the channel status information. The LED colors are interpreted as follows:

Green

-The associated channel information is being displayed on screen
-RS Out indicating communications is functioning

Yellow

-The associated channel has exceeded the alarm set point and the alarm output relay has changed state.
-The fan relay has been energized

Red

-The associated channel has exceeded the trip set point and the trip output relay has changed state.
-Indication of a fault condition

All messages and operating parameters are displayed on the screen. The DISPLAY MODE key controls the operating mode of the screen display allowing any one of four modes to be selected: **scan**, **auto**, **man**, or **Tmax**. An illuminated LED at the top left of the display indicates the active mode and pressing the DISPLAY MODE key toggles the four different modes The different modes display the following information.

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Scan

Each channel is scanned for approximately three seconds during which the actual temperature of that channel is displayed on the screen.

Auto

All active channels are scanned, but only the temperature of the hottest channel is displayed on the screen. This mode does not affect protection.

Man

The temperature for each channel may be viewed manually by pressing the UP or DOWN key. The information displayed on the screen will be that of the channel whose green LED is lit. All active channels are still scanned but only the temperature of the selected channel is displayed. **This mode does not affect protection.**

Tmax

This value is logged in memory and is the maximum historical temperature recorded on any active input channel. A green LED identifies the channel which produced this temperature value. If an actual monitored temperature value exceeds the Tmax value in memory, then the new value is stored as Tmax. The Tmax value may be reset by pressing the RESET key in this mode

Screen Messages

A variety of messages may be displayed on the screen. They may appear during programming or during normal operation as a result of component or unit failure. During the course of normal operation the following screen displays indicate fault conditions:

- FOC: Fault open circuit - RTD input to one or more channels has open circuited. An RTD may be disconnected or wires to it severed. This may also indicate that the number of active channels programmed does not match the actual number of RTD's connected or that RTD's have not been consecutively connected starting with channel 1. Indication is provided by illumination of the fault LED, operation of the fault output relay and identification of the affected channel by illumination of that channels green LED.. To reset the fault relay, push and hold the RESET key until RST appears on the screen.

- FCD: Fault sensor reading - RTD signal is abnormal. There is no visual indication the RTD is defective. The problem is detected by the internal circuitry of the NT538 10 CU and may be caused by a variety of reasons. Wire routing shielding and grounding are suspect . Identification is provided by illumination of the fault LED, operation of the fault output relay and identification of the affected channel by illumination of that channels green LED. This is a programmable feature that is enabled when the program option YES is selected (see programming) Sensitivity may be set numerically from 1-30. the lower the value the higher the sensitivity. Values between 1-10 could be useful in detecting a locked rotor on a motor To reset the fault relay, push and hold the RESET key

- FCC: Fault short circuit - RTD is short-circuited. The RTD has failed or the RTD type, and the unit are not compatible. Low resistance across an input channel causes this problem. Indication is provided by illumination of the fault LED, operation of the fault relay, and identification of the affected channel by illumination of that channels green LED. To reset the fault relay, push and hold the RESET key until RST appears on the screen. If all yellow and red channel LED's are simultaneously illuminated with the fault LED, it is likely that the RTD's are not compatible with the unit..

All other messages that may appear on the screen pertain to program or test functions. Refer to the programming or test sections for description s of those messages.

Light Test

This test is conducted automatically after completion of programming or viewing programmed information. It is intended to provide visual indication of all illuminated LED's and their operation.
It is advisable to carry out this test on a regular basis to ensure all lamps are functioning normally. Pressing the TEST key at any time allows the user to test all lamps.
If any lamp is not functioning the unit must be returned for repair.

Control Power

The NT538 10 CU has a universal power supply. It can be supplied with 24 to 240V AC or DC without respect to polarities.
The ground cable must be fixed to terminal # 41

ATTENTION: The unit may be damaged by over voltage when power is supplied directly from the secondary of the transformer it is monitoring. This may occur when the 240V is obtained directly from the secondary winding and there are fixed capacitors online. Use a control circuit transformer, with a secondary voltage of 24 to 120V AC or DC to avoid damage.

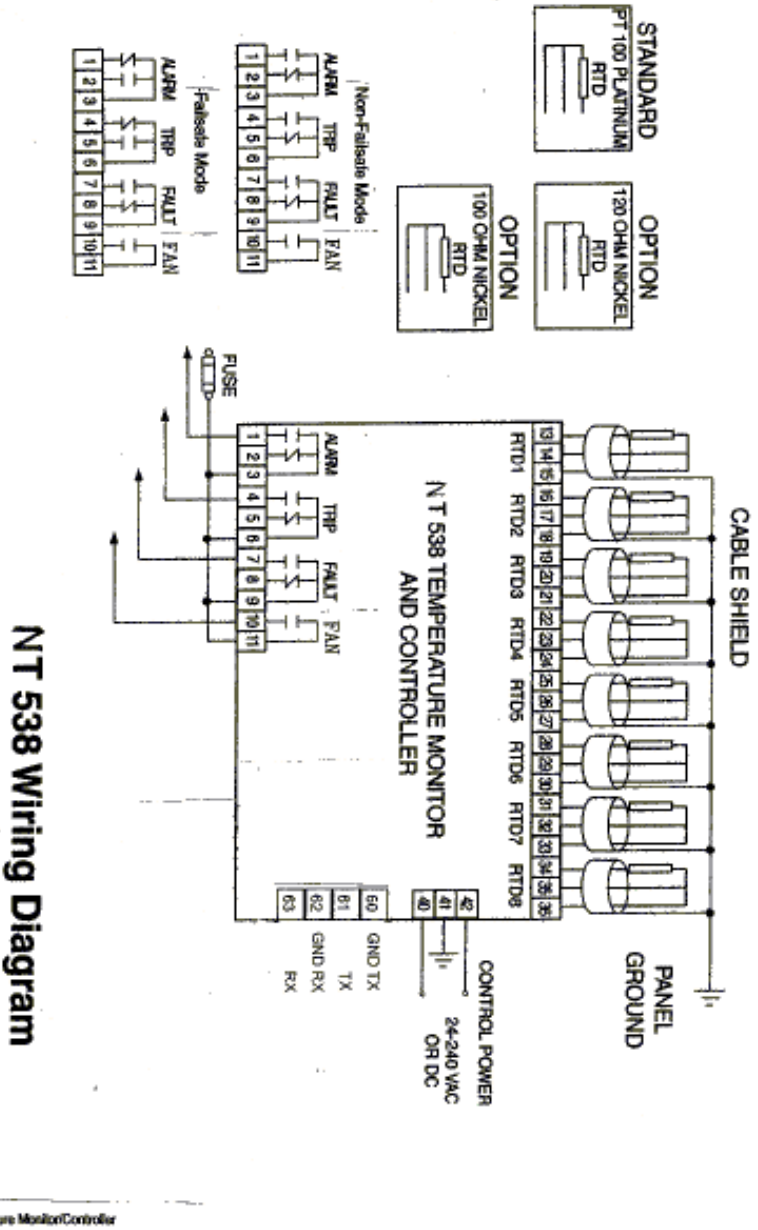
ATTENTION: Disconnect the power supply to the NT538 10 CU when conducting insulation testing with an AC or DC HiPot. Failure to do so may result in damage to the unit.

Wiring

Applicable to T538, NT538 and NT538 10 CU
Terminal blocks are located at the rear of the unit for all input channels (8), output relays (3) and control power.
The terminal blocks are removable for ease of wiring
Wiring connections are shown in Figure 2
Note: On NT models terminals 10 –11 are labeled "FAN"

Figure 2

Figure 2



Wiring (Cont.)

RTD Sensor wiring and routing

All sensor wiring must be:

- Separated from power wiring;
- Shielded cable with twisted conductors;
- Have a cross section of 0.5mm (22AWG);
- Be twisted conductor if no shield;
- Have tinned or silvered conductors;
- Be firmly fixed in the terminal board.

Inputs

The NT538 10 CU will accept up to eight, three-wire RTD inputs

The NT538 may also be ordered for use with 100 or 120-ohm, nickel RTD's. The RTD's must be terminated consecutively starting with channel 1, and the relay must be programmed for the number of active channels. (Maximum eight)

Outputs

The NT538 10 CU incorporates four output relays; Trip, Alarm Fault and Fan

- All relays are single-pole, double throw except Fan which is SPST
- The trip and alarm relays are independently programmable for fail-safe operation. The relay contacts will change state when the unit is energized, (control power applied) and no trips or alarms are present
- Each individual active channel can be programmed with trip and alarm temperature set points that are independent of other channels.
- The alarm and trip relays will change contact state when the respective set point temperature value is reached. The unit self–resets automatically when the actual temperature value declines 1°C (2°F) below the set point values. The unit will only reset when all actual temperature values have declined below the programmed values. Illuminated LED’s for alarm (yellow) and trip (red) flash coincidentally with the channel LED of the same color, when a set- point is exceeded. The channel indication ceases when the temperature falls below the set point value.
- The Fault relay is activated when the unit senses a defective RTD or component failure of the relay. This will also occur if temperatures are out of range. Max 0 to 220°C. If the fault relay can not be reset, the unit must be replaced.
- Fan operation is possible, by programming the fan relay.

Programming

Getting started

Programming the NT538 10 CU is simple and requires no special tools. The set point values for alarm and trip for each active channel should be at hand. The unit will automatically step through each program sequence and upon completion will resume normal operation.

The program sequence is as follows;

1) Set the number of active channels, maximum 8.
2) Input alarm temperature value for channel 1, range 0-220°C
3) Input trip temperature value for channel 1, range 0-220°C
4) Repeat steps 2 and 3 for all active channels.
5) Select fan operation Yes or No
   Input fan variables if above is programmed "Yes"
6) Select N.O. or N.C. for alarm relay
7) Select N.O. or N.C. for trip relay
8) Select FCD operation Yes or No
9) Press ENT to return to normal operating mode

Unit will perform light test and return to normal operation.

Programming Sequence

1) To begin programming, **press the PRG key for approximately five to seven seconds**. The screen message will change to PRG and the **PROG** light above the PRG key will illuminate. The unit will then advance to the first program selection, **NCH.** In the event program access is blocked the display will show **"noP".** This indicates an internal jumper has been removed and programming is not possible **To gain access**, the internal jumper must be reinstalled. This involves removing the exterior case and locating the removable jumper situated on the PC board. The jumper is installed from the factory to allow programming. For jumper location refer to item 20 page 10.
2) After each selection press the PRG key to advance to the next selection. At any time during the program sequence you may discontinue by pressing the ENT key. To enter programming again you must repeat the sequence above.
3) To review the entered values, momentarily press the PRG key and continue to do so advancing to each programmed value.
4) After advancing to any program selection, use the up/down keys to enter your selection, or set point value.

During the programming sequence a timer allows 60 seconds for any input. If time elapses and no input is made the unit reverts to normal operation.

As the unit advances to each of the program selections the main LED screen will display a message or set point value.

When entering set point values for channels 1 to 8, a green LED will illuminate indicating the channel being programmed. To the right of the display, are trip relay status indicators. As values for each relay as being entered the respective LED will illuminate The fault relay is not programmable and provides status indication only.

Programming (Cont'd)

Enter Program Values

1) Set the number of active channels
   Screen display: n.ch. with green LED's 1 to 8 illuminated
   Action: Scroll up/down
   Options: 1 to 8 illuminated LED's
   Complete: Press PRG—Advance
   Discontinue: Press ENT

2) Alarm temperature set point value for channel 1
   Screen display: Numerical, channel LED green and flashing yellow Alarm
   Action: Scroll up/down
   Options: 0-220°C
   Complete: Press PRG-Advance
   Discontinue: Press ENT

3) Trip temperature set point value for channel 1
   Screen display: Numerical, channel LED green and flashing red Trip
   Action: Scroll up/down
   Options: 0-220°C
   Complete: Press PRG-Advance
   Discontinue: Press ENT

4) Repeat above for each active channel

5) Select Fan operation
   Screen display: YES with yellow fan LED flashing
   Action: Scroll up/down
   Options: Yes/No
   Complete: Press PRG - Advance
   Discontinue: Press ENT
   "YES" *selection sequence:* Press PRG
   Screen display- ON- Press PRG
   Set fan on temp value—0-220°C press PRG
   Screen display OFF – Press PRG
   Set fan off temp value- 0-220°C – press PRG
   Screen display HFN – press PRG
   Set fan test interval 000= disable
   Numeric value sets hours between test, run time 5 minutes every interval

Programming (Cont'd)

6) Set Alarm contact status
Screen display: N.O.- yellow alarm LED flashing
Action: Scroll up/down
Options: N.O. non failsafe / N.C. failsafe
Complete: Press PRG-Advance
Discontinue: Press ENT

7) Set Trip contact status
Screen display: N. O. red trip LED flashing
Action: Scroll up/down
Options: N.O. non failsafe / N.C. failsafe
Complete: Press PRG - Advance
Discontinue: Press ENT

8) Set FCD operation.
Screen display: FCD
Action: Scroll up/down
Options: Yes / No
Complete: Press PRG – Advance
Discontinue: Press ENT
"Yes" selection sequence press PRG
Screen display numeric 1-30
Action: scroll up/down, select numeric value

The program selection automatically advances to each step. From step 8 It returns to step 1. At any time during the program sequence you may quit, by pressing the ENT key. After pressing the ENT key the unit performs a light test and reverts to normal operation During programming, pressing the PRG button saves the value entered.
If the value entered is invalid the unit will not accept the entry. The screen will display ERR (error) and the unit will not move to the next program mode until a valid program selection is entered.

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TECHNICAL SPECIFICATIONS

Power Supply

- Rated voltage 24-240 Vac-dc 50/60 hz
- Voltage limits 20-270 Vac-dc 50/60 hz
- Vdc with reversible polarities

Inputs

- Eight inputs RTD sensors – 3 wires
- Removable rear terminals
- Input channels protected against electromagnetic noises and spikes
- Sensor cable length compensation up to 500 m (1 mm²) 10 ohm max.
- Tecsystem bus interface

Tests and Performances

- Assembled in accordance with CE rules
- C-UL-US Approval # E194027
- Protection against electrical and magnetic noises: CEI-EN50081-2/50082-2
- Dielectric strength 2500 Vac for 1 min. from relays to sensors, relays to power supply, power supply to sensors
- Accuracy: ± 1% full scale, ± 1 digit
- Ambient operating temperature -20ºC to 60ºC (-4ºF to 140ºF)
- Humidity 90% non-condensing
- ABS self-extinguishing housing NORYL 94VO
- Front panel polycarbonate IP54
- Burden 3VA
- Data storage 10 years minimum
- Digital linearity of sensors signal
- Self-diagnostic circuit
- Opt. Protection treatment of electronic part
- Opt. front plastic protection
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Communication

- Opt Module - Output RS/485 Modbus™ RTU

Outputs

- Three Output relays (Alarm –Trip- Fan)
- One relay for sensor fault or abnormal unit operation (FAULT)
- Output contacts capacity: 5A-250Vac res.
- Arranged for output relays test
- Fail-safe/non - fail-safe programming of Alarm/Trip output relays
- Tecsystem bus interface

Display and Data Management

- One display, 13mm (0.5 in.) high 3 digit with 3 digit for displaying temperatures
- Eight LED's for displaying reference channel
- LED's indicating alarm or trip
- LED indicating fault
- Temperature control from 0-220°C
- Temperature monitoring 0 to 220°C
- Two thresholds for each input
- Sensors diagnostic (FCC-FOC-FCD)
- Programming by front push button
- Automatic output from programming cycle after 1 min. of no operation
- Wrong programming automatic display
- Programmed data call out
- Possibility of setting manual channel scanning or hottest channel
- Maximum temperatures storage

Number of channels software programmable from 1 to 8

Dimensions

- 96 x 96mm (3.78 x 3.78 in.) -DIN N43700-Prof. 140mm Deep (with rear terminals)
- Panel cutout 92 x 92mm (3.62 x 3.

Testing

All relays may be tested using the following procedure:

1) Press and hold the TEST key for 7 seconds. Initially all LED's illuminate, changing to the main screen display showing TST
2) Release the test key when the yellow relay test LED illuminates. The screen display will show OFF and the red LED indicating fault relay, is illuminated.
3) Test the fan, fault, alarm, or trip relay. Use the Scroll up/down keys to make the selection. The screen display will show the relay selected for testing. Yellow (alarm) and red (trip) LED's are visible as the relays are tested. To perform the test, press the SET (white print) key and check for contact operation. To reset press the RESET (white print) key.
4) To discontinue operation and revert to normal operation, press the TEST key.

At the start of the test, a timer is automatically initiated which reverts the unit to normal operation if no inputs are detected for a period of five minutes

Temperature Simulation.

Connect fixed or variable resistors across all channels to simulate RTD inputs.
All resistors must be connected to the input channel using the three terminations provided. This is achieved by terminating the resistor to the two lowest termination numbers of each channel, with a jumper from the middle to the highest number.
Example Channel # 1
Termination #'s 13-14-15
Connect the resistor across 13-14
Connect the jumper from 14-15
Repeat for all channels
The resistance values for all inputs must be variable between 9-20 ohms
Connect the NT538 10 CU to a suitable power supply.
Set the resistance values to a corresponding temperature value for a copper RTD. All RTD's have published resistance vs. temperature values.
For example, a resistance value of 9.04ohms will yield 0 degrees C. A resistance of 12.90 ohms yields a temperature of 100 degrees C. For an increase in resistance of .386 ohms the temperature increases by 10 degrees C.
Check to verify readings on the main display.
The unit is completely functional with the resistors connected, and complete evaluation is possible following the instruction manual.

Warranty

The NT538 10 CU is warranted for a period of 18 months from date of shipment.
Warranty is limited to repair or replacement of the defective product and no contingent liabilities will be accepted.
Warranty will be voided if the unit is found to be tampered with, or it has been damaged as a result of incorrect input or power supply connections, or is damaged as a result of transitory over voltages.
Freight expense is not covered under warranty.

Troubleshooting

Problem	Causes / Solution
The unit will not switch on, with control power energized	Check the terminal block for correct installation Check for voltage at terminal block
The sensor is damaged	The fault relay closes and the fault LED switches on. The green LED of the respective channel is illuminated. A message is displayed. FOC- sensor open FCC- sensor is short circuited
One of the eight channels is indicating fault, and displaying FOC/FCC	Check the sensor connections. Look for damaged sensors. Replace damaged sensor
When switching the unit on-off, alarm and trip relays energize	Strong electrical noise is being picked up on the power line. Install a transient suppressor (PT73) Check to ensure the shield of the sensor cable is connected to the panel ground Install shielded cable, or twist the sensor conductors
All the sensors are displaying FCC	Wrong wiring connections The terminal block is upside down
The temperature indicated by one, or more channels is wrong	The sensors are defective. Check the sensor resistance for compatibility, with your unit. The unit is calibrated incorrectly Return for repair
Sudden activation of the trip relay with normal operating temperature, One channel caused the occurrence	Sensor defective FCD Replace the sensor
With a control power source of 24VDC the unit switches off, and will not switch back on	Check the input voltage is between 20-24VDC Reconnect to a stable source of power Return if unit does not respond

Options

All options available with the NT538 10 CU are offered as accessory modules.
Optional modules are connected to the NT538 10 CU via the proprietary Tecsystem communications bus.
The connection is two wire twisted pair, with no set up required.
The NT538 10 CU has an indicator that illuminates when connected to an optional module
Modules may be mixed allowing complete flexib ility

- Optional modules
- Communication Modbus RS485 protocol
- Analog outputs – up to 8 channels
- Switched contact – up to 8 channels

Programming of modules is via DIP switches located on the respective module
Documentation of module feature will be forwarded under separate cover

Approvals

- Assembled in accordance with CE rules.
- Protection against electrical and magnetic noises CEI-EN50081-2/50082-2
- C- US approval, File No, E194027

Ordering

To order, select the basic model and the desired features from the selection Guide below.

	NT538	RTD		Busmod 8A		Conv8/420/A		Switch 8x
100 ohm platinum RTD	*	100PT	*	DIG	*	ANAL	*	Mod RL8-A
100 ohm nickel RTD		100 N		DIG		ANAL		Mod RL8-A
120 ohm nickel RTD		120 N		DIG		ANAL		Mod RL8-A
10 ohm copper RTD		10 Cu		DIG		ANAL		Mod RL8-A

* Specify the NT538 model based on the RTD type and add suffix for optional modules

Optional Module

Parts number	**Description**
Busmod 8A	Modbus RS485 protocol
Conv /420/8/A	8 channel 4-20 ma output
MOD RL 8-A	8 switch outputs

Note

The NT 538 Cu 10 and optional modules will be shipped as separate units, with individual part numbers shown.
Any item may be ordered by part number reference