SITEWATCH MIDI-8R-DC Remote Terminal Unit

Technical Handbook

for Sitewatch4

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1 - INTRODUCTION

1. The Sitewatch MIDI-8R-DC is an intelligent microprocessor based Remote Terminal Unit (RTU) which is used to monitor and control the operation of equipments at remote sites as part of a Supervisory Control and Data Acquisition (SCADA) system or a Telemetry System.

2. The RTU is powered by an external 12 or 24VDC supply, link selectable.

3. The RTU communicates with its Host computer, the Man Machine Interface (MMI) over Ethernet, Public Switched Telephone Network (PSTN), the Cellular Network (GSM/GPRS), Radios, Dedicated Lines, intranet or internet using modems or dedicated communications interfaces. Modems can be powered from the RTU.

4. The Sitewatch MIDI-8R-DC has 16 optically isolated digital inputs, 8 bulk isolated differentially selected analogue inputs and 4 single pole relay digital outputs fitted as standard. The digital input capacity can be increased to 24 by fitting a small expansion board. Analogue inputs can be configured by on-board links to provide current (4-20mA) or voltage (0-10 Volts) interconnection to site equipment.

5. The RTU has three serial data ports as standard. Typically, the first port is used for the main communications interface via a Modem and provides a connection to the Modem Monitor Port.

   The second serial port is available for either Interfacing to other Intelligent Equipments or Networking MIDI-8R-DC RTUs on a Local Area Network (LAN). A maximum of 4 RTUs can be connected on the LAN and can communicate with the Sitewatch Host using one communications interface (Modem) connected to the Master RTU.

   The third serial port is used for local interrogation via the (MTCE) maintenance connection on the RTU front panel.

6. The serial ports are typically supplied configured for RS232 connections, although RS485 and TTL interfaces are available using links.

7. The Sitewatch MIDI-8R-DC RTU is supplied in a 19 inch rack assembly that is 2U in height (88.1mm). The RTU is physically and functionally split into two printed circuit boards. The processor board is fitted at the front of the rack, the input/output board is mounted at the rear. All field terminations are made at the rear of the rack, connecting to D Type connectors.

8. A “User Panel” circuit board is mounted on the inside of the RTU front panel and provides two RS232 serial connections. The Maintenance Port (MTCE) is a 9way serial connection provided for local interrogation of the RTU; the Modem Monitor Port enables a technician to “spy” on the communications between the RTU modem and its processor board.

9. The RTU has built in data logging facilities for all inputs and a real time clock used to time stamp the logs. The data logging memory and real time clock are separately battery backed, thus maintaining logged data and the RTU time base in the event of local power failure. The baseline operational software (boot software) is held in non-volatile FlashROM memory with site and application specific software and configuration data held in a second FlashROM. Logged data is held in battery backed CMOS static RAM.

10. There are six LEDs on the front panel, these provide the following indication:

Blue	System power
Yellow	Watchdog (typically flashing at 2 Hz)
Red	Event/Alarm (Flashing=Event / Permanent=Alarm)
Green	Master/Slave RX (Good message received on LAN network)
Green	TX (data transmitted)
Red	RX (data received)

2 - PRINCIPLE OF OPERATION

1. Telemetry or SCADA systems comprise of a Host computer(s), either a dedicated PC based Workstation(s) located at a central office or the Lee-Dickens Ltd Web Based Bureau Service. The system will require a number of Remote Terminal Units (RTUs) located out in the field. The Host computer is the operator's Man Machine Interface (MMI) and allows him to monitor and control the status of the field equipment connected to the RTUs. The RTUs directly monitor and control equipments to which they are connected and report operational status, history and alarm conditions back to the Host computer via a communications media. The available communications media include Switched Telephone Networks, Cellular telephones, Radios, Intranet, Internet or dedicated lines. Data reported by the RTUs is logged, analysed and displayed at the Host computer for an operator who can initiate control action at the RTU site via RTU outputs if necessary.

2. The Sitewatch MIDI is an intelligent microprocessor based stand-alone RTU which has been specially developed for use in industrial environments. Its operation is controlled by a specialist multitasking software package written in the Forth software language. RTU hardware and software is common at all sites except for a security code, which is a unique identifier for a particular RTU within a telemetry system. Operational parameters which configure an RTU for a particular site application are down loaded from the Host (or from a local computer) when the site is commissioned. Once commissioned, the Sitewatch Host polls the RTU for all status points

3. The multi tasking software allows separate tasks to be set up for the monitoring communications and for dedicated control routines to be established within the RTU for site connected equipment.

4. The interactive features of the Forth language allow local interrogation of the RTU and its inputs and outputs using a local terminal or portable computer. The local terminal or portable computer is connected to the Maintenance (MTCE) port located on the MIDI-8R-DC RTU front panel, interconnections are made using a standard RS232 extension cable.

   For Local Interrogation and a list of interactive words see 7 - PORTABLE COMPUTER INTERROGATION

5. A Modem Monitor Port is located on the front panel of the MIDI-8R-DC RTU.

   This port is only active on the Master MIDI-8R-DC RTU.

   Using a terminal or Laptop computer and a standard RS232 extension lead, communications between the modem and processor board can be monitored. The direction of monitored communication can be altered using the TX/RX toggle switch.

   With the switch in the TX position you view communications Transmitted from the modem; in the RX position you view data received by the modem.
   The green TX and red RX leds will flash as data is transmitted and received.

6. RTU operation can be adapted to meet specific system requirements by modifying the standard software package or by configuration of the application's specific parameters.

3 - INSTALLATION

3.1 RTU

1. **The MIDI-8R-DC RTU Enclosure**. The RTU is housed in a standard 19" Rack mount Aluminium enclosure that is 2U in height.
   The RTU is approximately 483mm wide, 88mm (2U) high and (ignoring the front panel handles and incorporating the earth stud at the rear of the rack) is 370mm in depth.

2. **Siting the Enclosure.** The enclosure should be fixed horizontally to a standard 19" cabinet or frame assembly.

3. **Installing the RTU.** The MIDI-8R-DC rack should be fixed using four M6 caged nuts, M6 x 20mm bolts and M6 plastic cup washers. These items will typically be supplied separately with the frame or cabinet assembly.

4. **Cable Interconnections.** Ensure that there is sufficient room at the rear of the cabinet for termination of all interconnections, remember to allow room for the insertion and extraction of connectors. The rack mount MIDI-8R-DC RTU can be installed without removing the enclosure lid or the RTU electronics.
   All cables connecting to the RTU should be screened.
   Ensure that the MIDI-8R-DC RTU is earthed using the earth stud located at the rear of the rack to the primary earth of the
   frame or cabinet.

5. **Power.** As standard the MIDI-8R-DC is supplied linked for a nominal 12Vdc supply although the RTU can be configured for 24Vdc.
   The power is connected to the RTU via the 'Neutrik' connector located on the rear panel of the RTU. The MIDI-8R-DC RTU power supply is fused with a 20mm 1 amp anti surge fuse.

6. **Digital and Analogue Inputs and Outputs**. Connect required inputs and outputs as shown in Section 3.2. Ensure that the links are correctly set for each channel and that all external cabling is potential free where appropriate before connection to the RTU terminals.

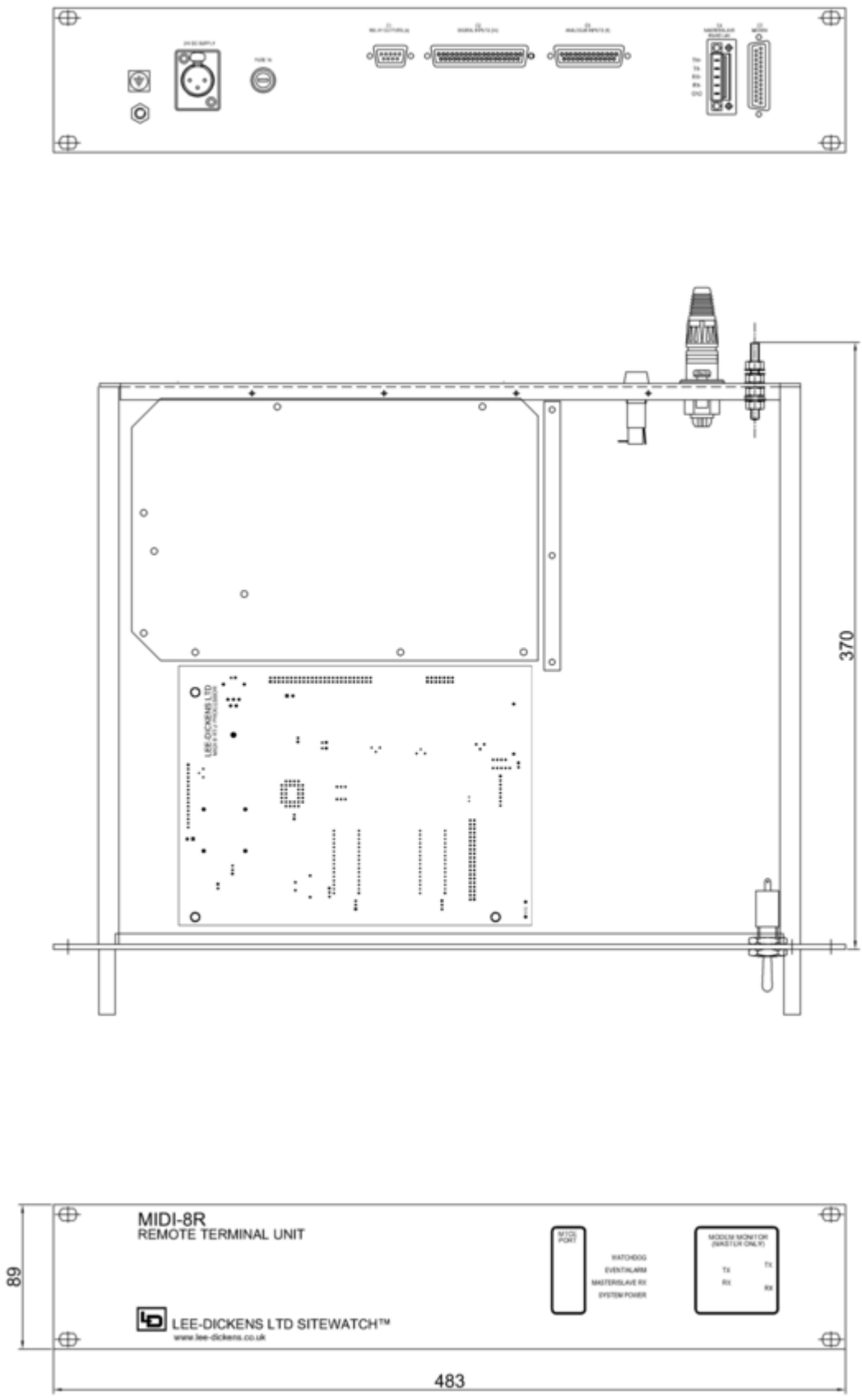


Figure 1 – RTU Drawing

3.2 FIELD CONNECTIONS

All field connections are made by D type connections located at the rear of the RTU; these connections accommodate analogue inputs, digital inputs, digital outputs.

Power Supply

Pin	Function
1	12 / 24 Vdc (Positive)
2	0V (Negative)
3	No connection

Digital Inputs (connector ref:C2)

Channel Number	Positive	
	Connector	Pin
1	C2	29
2	C2	24
3	C2	10
4	C2	5
5	C2	28
6	C2	23
7	C2	9
8	C2	4
9	C2	8
10	C2	3
11	C2	26
12	C2	21
13	C2	7
14	C2	2
15	C2	25
16	C2	20
17	C2	34
18	C2	15
19	C2	33
20	C2	14
21	C2	13
22	C2	31
23	C2	12
24	C2	30

Common +		Common -	
Connector	Pin	Connector	Pin
C2	6	C2	1
C2	27	C2	11
		C2	22
		C2	32

Analogue Inputs (connector ref:C3)

Channel Number	Positive		Negative	
	Connector	Pin	Connector	Pin
1	C3	23	C3	18
2	C3	10	C3	5
3	C3	22	C3	17
4	C3	9	C3	4
5	C3	8	C3	3
6	C3	20	C3	15
7	C3	7	C3	2
8	C3	19	C3	14

Common	
Connector	Pin
C3	21
C3	6
C3	16
C3	1

Relay Outputs (connector ref:C1)

Channel Number	Common		Normally Open	
	Connector	Pin	Connector	Pin
1	C4	1	C4	3
2	C4	6	C4	8
3	C4	2	C4	4
4	C4	7	C4	9

Connections inside the MIDI-8R-DC RTU.

TB1 - DC Power Input:

1 Earth
2 (-)VDC
3 +VDC

TB2 - Digital Inputs

Upper		Lower	
1	Input 1	2	Input 2
3	Input 3	4	Input 4
5	Input 5	6	Input 6
7	Input 7	8	Input 8
9	I/O +ve supply	10	I/O –ve supply /Common
11	Input 9	12	Input 10
13	Input 11	14	Input 12
15	Input 13	16	Input 14
17	Input 15	18	Input 16
19	I/O +ve supply	20	I/O –ve supply /Common

TB4 - Analogue Inputs

Upper		Lower	
1	Input 1+	2	Input 1-
3	Input 2+	4	Input 2-
5	Input 3+	6	Input 3-
7	Input 4+	8	Input 4-
9	Common	10	Common
11	Input 5+	12	Input 5-
13	Input 6+	14	Input 6-
15	Input 7+	16	Input 7-
17	Input 8+	18	Input 8-
19	Common	20	Common

TB3 - Digital Outputs

Upper		Lower	
1	Digital Output 1 N/O	2	Digital Output 1 Common
3	Digital Output 2 N/O	4	Digital Output 2 Common
5	Digital Output 3 N/O	6	Digital Output 3 Common
7	Digital Output 4 N/O	8	Digital Output 4 Common

3.3 DIGITAL INPUT CONNECTION

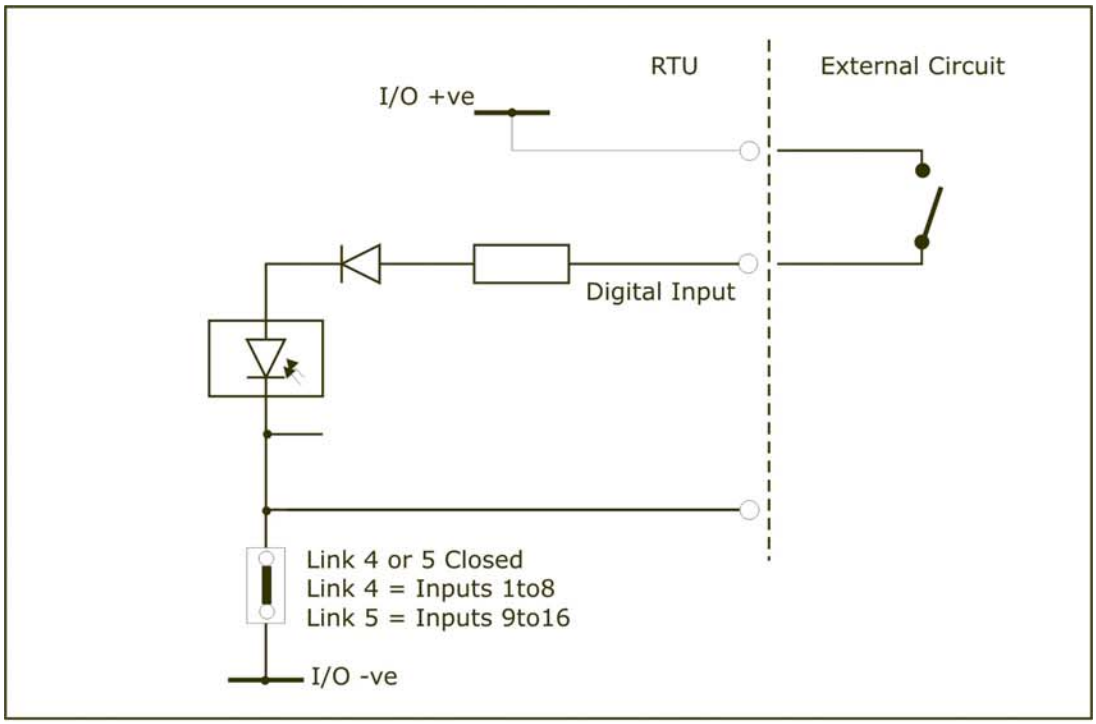


Figure 2 - Potential Free Contact

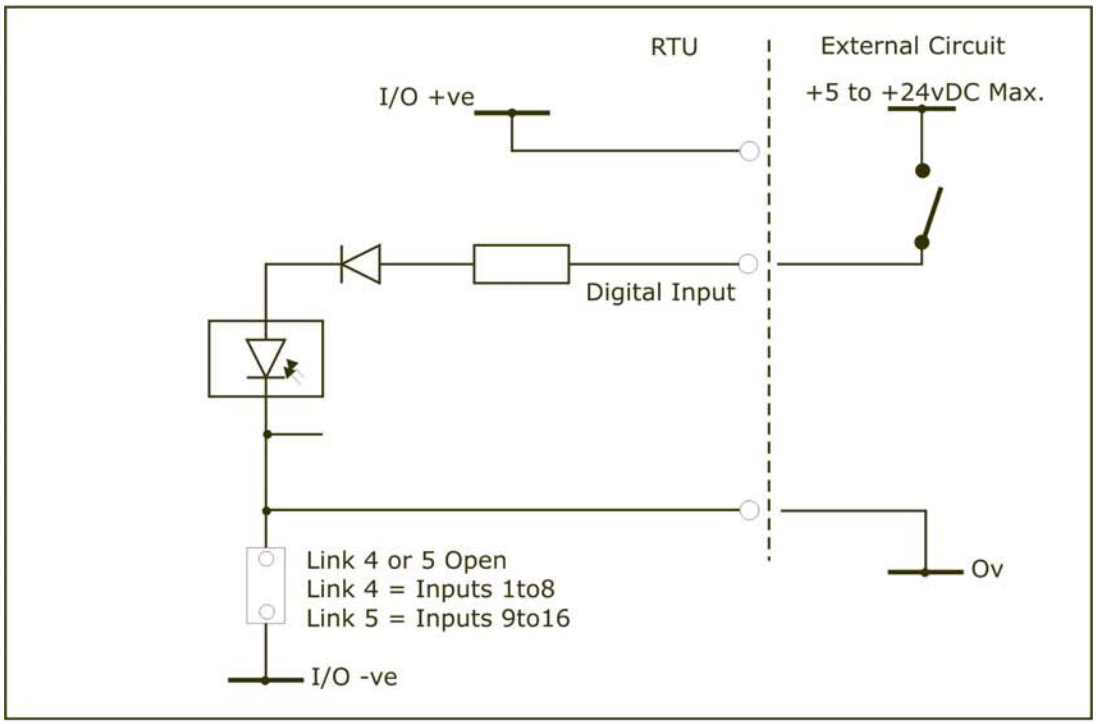


Figure 3 - Externally Wetted Contacts

3.4 ANALOGUE INPUT CONNECTIONS

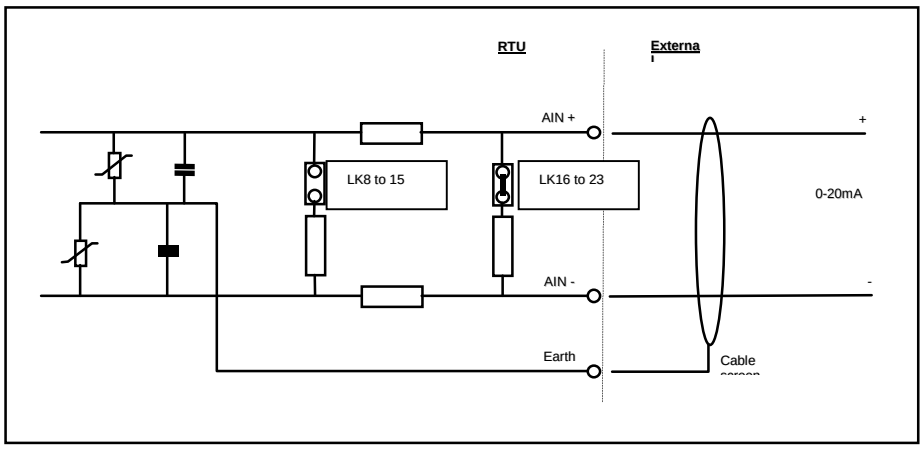


Figure 4 - 0 to 20mA Analogue Input

Note - Scaling for 4-20mA input is carried out in the RTU

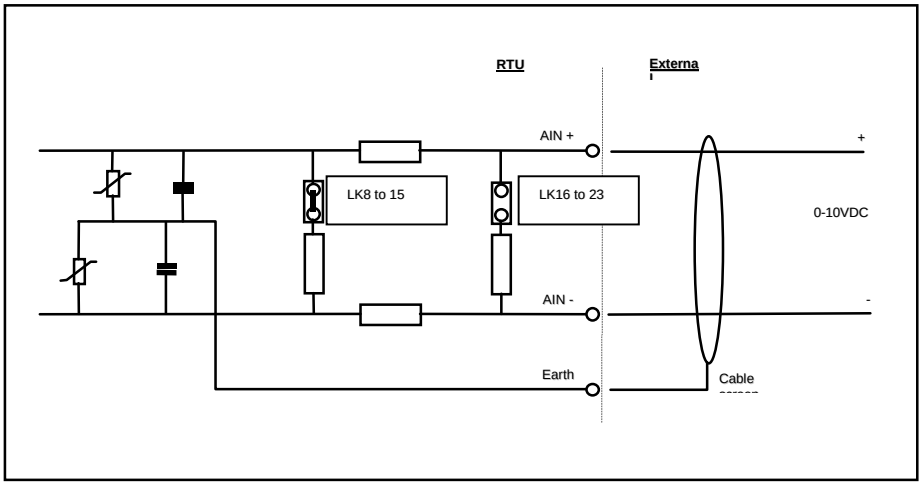


Figure 5 - 0 to 10VDC Analogue Input

Note - Scaling for different voltage ranges is carried out in the RTU

3.5 DIGITAL OUTPUT CONNECTIONS

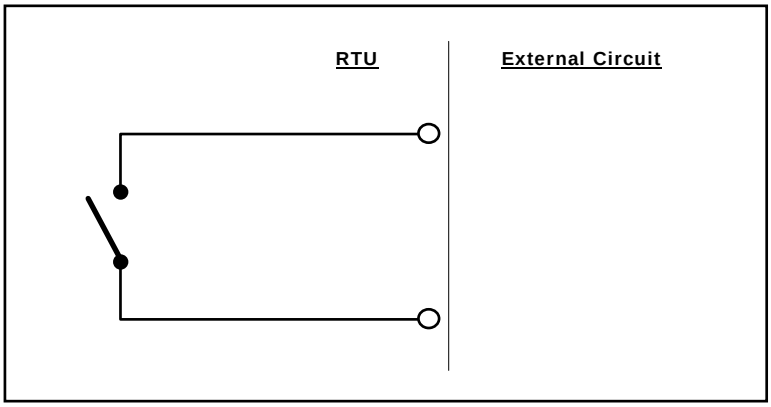


Figure 6 - Digital Output Circuit

4 – COMMISSIONING

MIDI-8R-DC RTU Pre-Checks

The MIDI-8R-DC RTU is shipped with its Memory Backup and Real Time Clock battery links removed from the Processor Board.

1. Replace Links LK2 and LK3 on the Processor Board

2. Ensure that Links LK5 and L6 on the Processor Board are removed.

3. Ensure that the red battery lead is connected to the positive battery terminal.

Sitewatch Host

1. The RTU is commissioned by configuration of the operational parameters received from the Sitewatch Host and by interconnection and testing of the input/output circuits at the RTU.

2. Commissioning procedures for operational parameters are detailed in the Sitewatch Host Operator's handbook and should be followed once the RTU commissioning procedures detailed below have been completed.

4.1 POWER SUPPLY

Switch on the incoming power supply and ensure that the yellow LED (LE1) on the input/output board is illuminated, typically the yellow LED (LD3) on the processor board flashes on and off within 15 seconds of power switch on. This confirms that the MIDI-8R-DC RTU is serviceable.

If the red LED (LD2) flashes and the yellow LED (LD3) is off then the RTU is in Fault Code. (see fault diagnosis ref 10 - FAULT FINDING)

4.2 INPUT/OUTPUT CIRCUITS

4. Digital Inputs. Set Links LK4 and LK5 (I/O negative power supply) configuration as described in ` 7. Check each of the inputs operates correctly as indicated using a terminal or laptop computer connected to the MIDI-8R-DC Maintenance MTCE port. If externally wetted, ensure that the wetting voltage is within the specified range for the digital inputs (+5 to +24VDC).

   For interactive command see 7 - PORTABLE COMPUTER INTERROGATION

5. Analogue Inputs. Set input links for each of the analogue input channels to the required input configuration as described in Section 7. Check the value displayed on the LCD (n/a to rack mounted version) or computer equates with the analogue input value measured across the input terminals, taking into account any offset value.

6. Digital Outputs. Before activating any digital outputs ensure that the equipment to be operated by the outputs is in a safe condition for testing. Activate the appropriate output using a terminal or laptop computer connected to the MIDI-8R-DC Maintenance MTCE port. Ensure that the relay contact changes over and that the external equipment control interconnection is correct.

4.4 LED Activity

LED activity on the front panel of MIDI-8R-DC will give indication as to the alarm and communication status of the RTU.

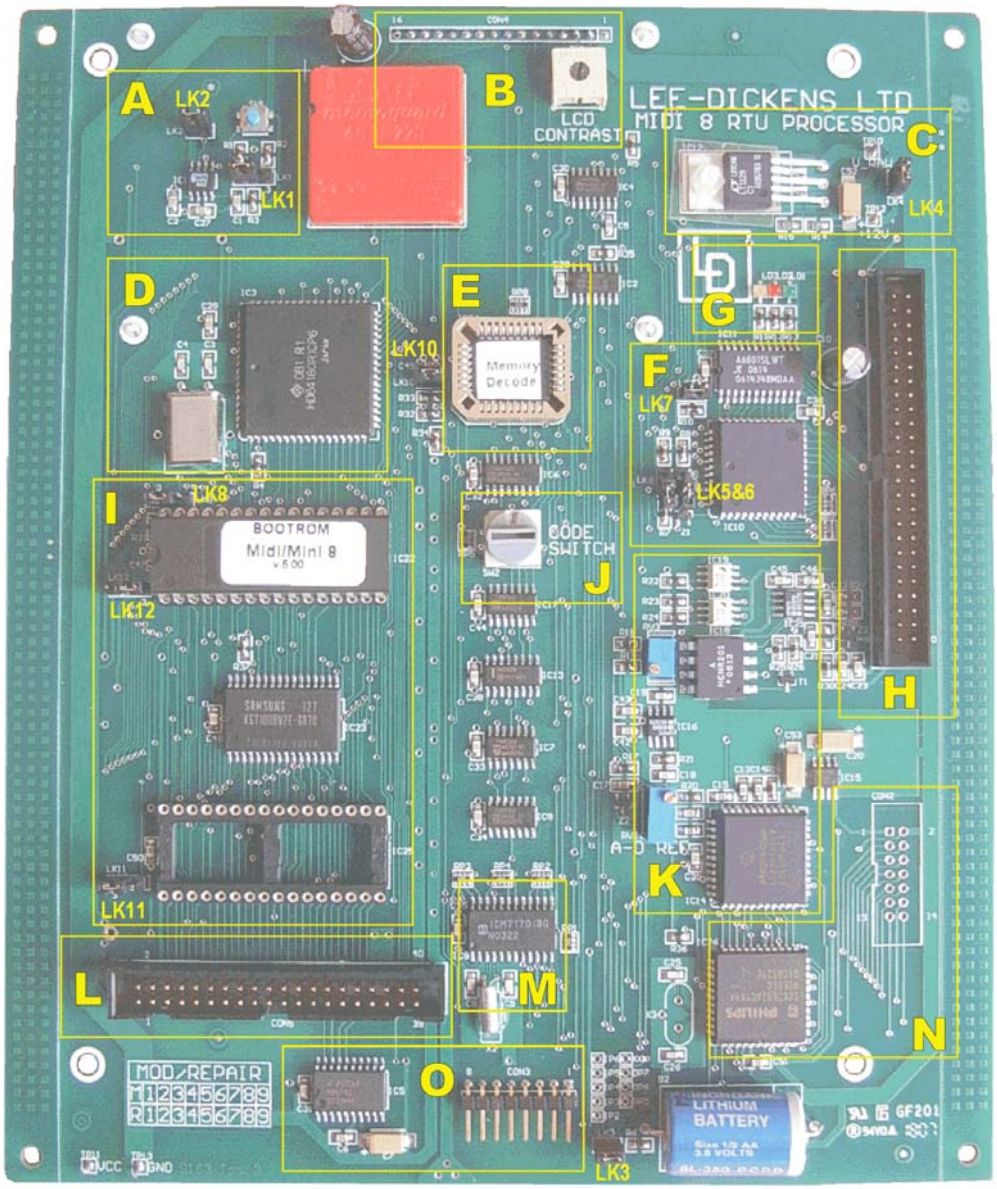
0 = off
• = on
* = flash

Front Panel Leds	Led Colour		Fault Code	Start Up Sequence 1	2	3	4	5	No Event/Alarm No Comms	Event	Alarm	Talking to Host	Talking (Master/Slave)
Watchdog	Yellow			•				*	*	*	*	*	*
Event/Alarm	Red		*	•	•					*	•		
M/S RX	Green			•	•	•							*
Sys Power	Blue			•	•	•	•	•	•	•	•	•	•
MM TX	Green											*	
MM RX	Red											*	

5 - TECHNICAL DESCRIPTION

5.1 PROCESSOR CARD

Refer to Circuit Diagram 9161 Sheets 1- 6 (CPU 801-SCH01)
PCB Assembly 9162 and Parts List SL9162



Designation	Description
A	Watchdog and Reset
B	LCD Interface (n/a to rack mounted version)
C	Isolated DC Power Supply
D	Microprocessor
E	Chip Select and Memory Decoder
F	General Purpose Parallel Input/Output
G	LEDs – Status Indicators
H	Power I/O Board Connector
I	Memory Devices – FlashROM
J	ID Code Switch
K	Analogue to Digital Converter circuit (A to D)
L	Expansion Connector
M	Real Time Clock
N	UART and Serial Interface (when fitted)
0	Keypad Encoder and Interface

1. The processor card uses a high integration Hitachi HD64180 microprocessor (IC3) with two on board serial ports. Direct Memory Addressing (DMA), multi level interrupts and multiple timers. The processor operates at 12.288 MHz and has a 19-bit address bus and 8 bit data bus. The processor circuit has space for up to 1.5Mbytes of memory decoded on the processor board with capacity for a further 1Mbyte on an expansion board. It uses 128Kbytes (or 512Kbytes) of 'Boot' FlashROM (IC22) for boot-up and recovery application program storage, 128Kbytes of battery backed static CMOS RAM memory (IC23) for logged data, 128Kbytes (or 512Kbytes) of Flash ROM (IC25) for the main application program and non-volatile configuration details.

2. The memory map is decoded via the 27256 OTP ROM IC24. The EPROM is decoded from 0-16K and 64-80K in the memory map. IC1 is a hardware watchdog timer which provides 'power on reset' and 'power fail' signals for the processor, standby battery supply changeover for the RAM circuits, a manually operated reset via push button SW1 and processor reset in the event of software corruption. The processor resets the watchdog timer via the I/O decoder IC6 using address 1000 HEX. The processor normally resets the watchdog timer five times each second. If it fails to provide a reset for 1.5 seconds the processor is reset, causing a hardware and software re-initialisation.

3. IC9 is a real time clock, which is battery backed. It has its own crystal controlled oscillator, which is factory adjusted to provide an accurate real time base for the system operation. The real time clock is addressed at I/O address 5000 HEX and is configured by the software to provide interrupts at 1Hz for process timing.

4. IC11 is an 8 way latched output driver addressed at I/O address B000 HEX which is used to drive 3 status indication LEDs on the processor card, the LED backlight on the Liquid Crystal Display, the modem power switch-on circuit and 3 outputs relays on the input/output card.

5. IC14 is a 12 bit dual slope integration analogue to digital converter which is optimised for noise rejection at 50 or 60Hz dependant on country of use. A stabilised zener reference Z2 is used to generate the A-D converter reference via RV2, RV2 being set to a value of 50% of the A-D full scale input. The A-D converter is addressed at I/O address 7000 HEX and the output value is read in two bytes, HEX 7000 being the lower 8 bits and HEX 7001 the most significant 4 bits, input polarity and A-D over-range. IC15 is a +5V to -5V DC to DC converter which provides -5V supplies for the A-D converter and the analogue input Operational Amplifier IC16. IC13 is a quad latch which is used to control run/hold on the A-D and to select the appropriate analogue input channel to the A-D converter from opto-coupler IC22 and the multiplexer on the I/O card. Analogue inputs are optically isolated from the A-D converter input via the opto-coupler IC18 and its input amplifier IC21.

6. IC10 is a Programmable Input/Output (PIO) device which is used to read on board switches and links, digital inputs on the Power and I/O board and to control outputs which select memory banks, multiplex blocks of digital inputs and control the fourth output relay. It is addressed at I/O address 9000 HEX and has 3 ports, which are software configured as inputs or outputs. Port A is used to decode the HEX code switch SW2, the power fail input, and the A-D converter end of convert signal. Port B reads multiplexed digital inputs and Port C controls the appropriate output circuits.

7. IC26 is a dual serial port controller, which is fitted when additional serial interfaces are required. External serial ports can be multiplexed into the dual serial port controller using output selection lines on IC26.

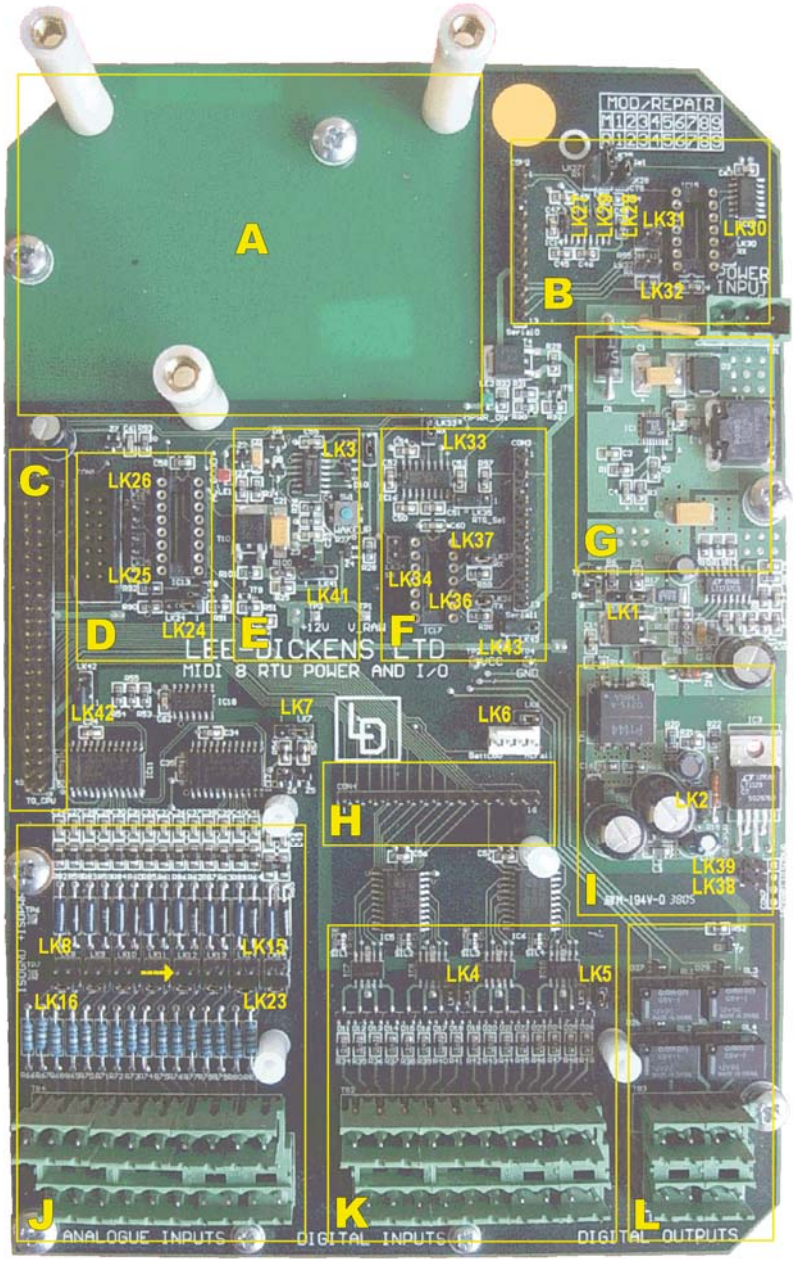
8. I/O address 3000 HEX is used to switch off power supplies via the battery control circuit on the input/output card. The alarm output from the real time clock IC19 pin 12 can be used to switch on the power supplies via the battery control circuit or manually via wake up push button SW1 on the I/O card.

9. IC5 is a hex keyboard encoder with a built in switch de-bounce circuit. It is addressed at I/O address F000 HEX and provides an interrupt to the processor on interrupt 2 when a key is pressed.

10. CON 1 connects the power, serial data circuits, the digital and analogue circuits between the processor card and the input/output card. CON 2 connects the serial expansion board to IC26, CON 3 connects to the battery switch, CON 4 connects the LCD (n/a to rack mounted version) and CON 5 connects the memory expansion board.

5.2 POWER / INPUT-OUTPUT CARD

Refer to Circuit Diagram 9151 Sheets 1-9 (P1 0801-SCH00)
PCB Assembly 9152 and Parts List SL9152



Designation	Description
A	Designated area for Battery and Modem
B	Serial Port 0 (RS232 or RS485)
C	Interconnection to the Processor Board
D	TTL Modem Interface
E	Power Control Circuit
F	Serial Port 1 (RS232 or RS485)
G	+5VDC Power Supply
H	Interconnection to Input Expansion Card
I	Isolated +12VDC or +24VDC
J	Analogue Input Circuits
K	Digital Input Circuits
L	Digital Output Circuits

11. The Input/Output Card provides the "real world" interface for the Remote Terminal Unit. All input/output connections are made via plug-in screw clamp terminals which can be disconnected without disturbing the field wiring.

12. Incoming power supplies are nominal 12VDC or 24VDC (link selectable) wired via a 3 way terminal block on connector TB1, Pin1 Earth, Pin2 OV and Pin3 +VDC.

13. The RTU is protected from reverse polarity connections using diode D1. F1 protects the RTU from being damaged by large current surges. This is a non-replaceable device that automatically resets when the overload has been corrected.

14. The incoming DC supply feeds IC1 to give the regulated +5VDC rail.

15. IC2 controls the DC to DC converter which provides the isolated 12VDC or 24VDC (Link Selectable) supply to the RTU input circuits. The transformer primary is switched by the FET T2 whilst IC3 regulates this supply.

16. ICs 7 to 10 are quad opto-isolators, which electrically isolate the 16 digital input circuits from the processor power supplies. IC's 5 and 6 are used to multiplex the digital inputs to the processor board in blocks of 8. Each block of 8 digital inputs has a common connection and the inputs can be selected for use with potential free external contacts powered from the RTU (LK4/5 fitted) or for use with externally powered contacts (LK4/5 open). A diode on each input circuit prevents reverse voltage from damaging the opto-isolator LED and a resistor restricts the input current.
17. Digital Input 16 can be assigned to monitor the RTU Battery indicating alarm Low Status via connector CON6, this is link selectable by making link LK6.

18. Inputs to external contacts are made via plug-in screw connectors on TB2.

19. IC11 and IC12 are both 4 way differentially selected analogue input multiplexers, which select analogue inputs 1 to 4 and 5 to 8 respectively. Only one input is selected at any time and is connected through to a common output. Each input can be selected for current (4-20mA) or voltage (0 to 10.0 VDC) input. Two series resistors and VDR's connected to Earth on each input prevent over-range inputs from damaging the multiplexers and two

capacitors connected to earth provide noise filtering.

20. The analogue input circuits are powered by the regulated isolated I/O power supply. The multiplexer selection lines and the analogue output of the multiplexer are optically isolated from the RTU processor supplies by opto couplers on the processor board.

21. Plug-in screw connectors are provided for all analogue inputs and the cable screen (Earth/Common) on TB4.

22. Relays 1 to 4 are single pole normally open contacts driven from the processor card as digital outputs 1 to 4. The relay contacts are taken to plug in screw connectors on TB3.

23. IC14 converts serial port 1 TTL levels to RS232 levels. IC15 converts serial port 1 TTL levels to RS485 levels when fitted. (Link Selectable)

24. IC14 converts serial port 0 TTL levels to RS232 levels for driving a modem if necessary. T8 acts as an inverter for the DCD signal from the modem if required and link LK24 allows DCD to be isolated or connected as necessary.

25. A sub board which connects an additional 8 digital inputs, or 2 pulse inputs or 4 digital outputs can be connected onto the input/output card via CON 4. All power supplies and associated processor inputs for the sub card are provided and interconnected on the standard RTU.

6 - HARDWARE CONFIGURATION

1. The Sitewatch MIDI-8R-DC Remote Terminal Unit is designed as a generalised unit which can be hardware configured before despatch or by the user on site to fulfil a specific applications requirement.

2. Hardware configuration is achieved by setting links and switches into appropriate positions to achieve the required function or input/output connection or scaling.

BOLD font indicates the normal link status of a MIDI-8R-DC RTU

6.1 PROCESSOR CARD

6.1.1 Link Functions (for guide see Section 12)

LK1	- RAM battery link. if RTU supply 12VDC **(Link Pins 1-2)** (Link Pins 2-3) if RTU supply 24VDC
LK2	- Memory Backup (link normally fitted[1])
LK3	- Real Time Clock Battery Backup **(fitted[2])**
LK4	- 12VDC supply, required when Midi8 Power I/O board is present **(fitted)**
LK5	- Test purposes **(Not Fitted)**
LK6	- Test purposes **(Not fitted)** - Pulse Dial (Fitted)
LK7	- Extra Address 1 Signal Enabled **(Fitted)** Extra Address 1 Signal Disabled (Not Fitted)
LK8	- Boot FlashROM programmable (Link Pins 1-2) Boot FlashROM write protected **(Link Pins 2-3)**
LK10	- Address Decoder programmable (Not Fitted) Address Decoder write protected **(Fitted)**
LK11	- FlashROM Selection for type 29040 (Link Pins 1-2) for type 28010 **(Link Pins 2-3)**
LK12	- BootROM Selection for type 29040 (Link Pins 1-2) for type 28010 **(Link Pins 2-3)**

6.1.2 LED Functions (application specific)

Blue	System power
Yellow	Watchdog (typically flashing at 2 Hz)
Red	Event/Alarm (Flashing=Event / Permanent=Alarm)
Green	Master/Slave RX (Good message received on LAN network)
Green	TX (data transmitted)

[1] LK2 normally removed for storage – needs to be inserted during commissioning
[2] LK3 normally removed for storage – needs to be inserted during commissioning

Red RX (data received)

See also Section 4.4

6.1.3 Switch Functions

SW1	-	Manual reset push button
SW2	-	HEX Code switch - application specific

6.1.4 Potentiometer Functions

RV1	-	LCD contrast (n/a to rack mounted version)
RV2	-	A-D converter reference (span)
RV3	-	Analogue input zero

6.1.5 Connector Functions

CON 1	Power and serial ports - processor to I/O card Analogue and digital inputs and outputs - processor to I/O card
CON 2	Maintenance (MTCE) Port
CON 3	Battery Switch ON/OFF status
CON 4	Not Used
CON 5	Not Used

6.1.6 Plug in Devices

IC22	27C256	CMOS Flash ROM - RTU operational code
IC25	28F010	CMOS Flash ROM - RTU applications code
IC24	27C256	CMOS OTP ROM

6.2 INPUT/OUTPUT CARD

6.2.1 Link Functions (for guide see Section 12)

LK1	- 12VDC Unregulated Output (Link Pins 1-2) 24VDC Unregulated Output **(Link Pins 2-3)**
LK2	- 24VDC Regulated Isolated Output **(Link Pins 1-2)** 12VDC Regulated Isolated Output (Link Pins 2-3)
LK3	- Real Time Clock Interrupt Enabled **(Fitted)** Real Time Clock Interrupt Disabled (Not Fitted)
LK4	- Digital Input 1 to 8 common connected to the RTU I/O –ve Wetting by RTU I/O power **(Fitted**) Wetting by external power supply (Not Fitted)
LK5	- Digital Input 9 to 16 common connected to the RTU I/O –ve Wetting by RTU I/O power **(Fitted)** Wetting by external power supply (Not Fitted)
LK6	- Digital Input 16 Enable, UPS100 Battery Low Detection (Fitted) Digital Input 16 Disable, UPS100 Battery Low Detection **(Not Fitted)**
LK7	- if isolated 12VDC power supply is in use (Link Pins 1-2) if isolated 24VDC power supply is in use **(Link Pins 2-3)**

LK8 -15 - Analogue Inputs 1 to 8
0-10VDC Voltage Input Selected.(Fitted)
Ensure links 16-23 are not fitted.

LK16-23 - Analogue Inputs 1 to 8
0-20mA Current Input Selected. **(Fitted)**
Ensure links 1-8 are not fitted.

LK24 - DCD Normal **(Link pins 1-2)**
- DCD Low (Link Pins 2-3)

LK25 - Connects RX signal of Port 0 to TTL interface **(Not Fitted)**
In this case Link27 and Link30 should be not be fitted.

LK26 - Connect CTS signal of Port 0 to TTL interface **(Not Fitted)**
In this case Link28 should be not be fitted.

LK27 - RX signal of Serial Port 0 to RS232 Interface **(Fitted)**
In this case Link25 and Link30 should be not be fitted.

LK28 - Connect the CTS signal of Serial Port 0 to the RS232 interface **(Fitted)**
In this case Link26 should be not be fitted.

LK29 - (Link Pins 1-2) RTS Low before conversion to RS232
No Modification to RTS before conversion to RS232
(Link Pins 2-3)

LK30 - Connects RX signal of Port 0 to RS485 interface (Fitted)
In this case Link25 and Link27 should be not be fitted.

LK31 - Enable RS485 TX Terminating Resistor to Serial Port0 (Fitted)
Disable RS485 TX Terminating Resistor to Serial Port0
(Not Fitted)

LK32 - Enable RS485 RX Terminating Resistor to Serial Port0 (Fitted)
Disable RS485 RX Terminating Resistor to Serial Port0
(Not Fitted)

LK33 - Connects RX signal of Port 1 to RS232 interface **(Fitted)**
In this case Link34 should be not be fitted.

LK34 - Connects RX signal of Port 1 to RS485 interface (Fitted)
In this case Link33 should be not be fitted.

LK35 - RTS High before conversion to RS232 (Link Pins 1-2)
No Modification to RTS before conversion to RS232
(Link Pins 2-3)

LK36 - Enable RS485 TX Terminating Resistor to Serial Port1 (Fitted)
Disable RS485 TX Terminating Resistor to Serial Port1
(Not Fitted)

LK37 - Enable RS485 RX Terminating Resistor to Serial Port1 (Fitted)
Disable RS485 RX Terminating Resistor to Serial Port1
(Not Fitted)

LK38-39 - Disable Unregulated Isolated Power Supply (Fitted)
Enable Regulated Isolated Power Supply **(Not Fitted)**
When links fitted, ensure IC3 is removed.

LK41 - if using 12VDC RTU power supply **(Link Pins 1-2)**
if using 24VDC RTU power supply (Link Pins 2-3)

LK42-43 - if Midi8 Processor Board connected **(Link Pins 1-2)**
if Midi3 Processor Board connected (Link Pins 2-3)

6.2.2 LED Functions

LE1 Yellow - Power on
LE2 Red - Modem powered

6.2.3 Switch Functions

SW1 Wake Up

6.2.4 Connector Functions

CON1 Not Fitted
CON2 **RS232 Interface to Serial Port 0 (modem) and Modem Monitor**
or
RS485 Interface to Serial Port 0
or
TTL
CON3 RS232 Interface to Serial Port 1 (LAN Port)
or
RS485 Interface to Serial Port 1 (LAN Port)
or
TTL
CON4 Input Expansion Card
CON5 Interconnection with the Processor Board
CON6 Status Monitor from UPS100 (not used on Midi-8R-DC)
CON7 Connection to Unregulated Isolated Power Supply Output.

TB1 RTU DC Power Supply Connection
TB2 Digital inputs 1-16
TB3 Digital outputs 1-4
TB4 Analogue inputs 1-8

7 - PORTABLE COMPUTER INTERROGATION

1. There are a number of routines that can be run to test individual elements of the MIDI-8R-DC RTU. These are:

   1 ANALOGUE INPUTS
   2 DIGITAL INPUTS
   3 DIGITAL OUTPUTS
   4 REAL TIME CLOCK
   5 SERIAL PORTS

2. The equipment required is a standard terminal or computer set to 9600 baud, 8 data bits, 1 stop bit, NO parity and an RS232 extension lead. The computer should be running the proprietary Lee-Dickens Sitewatch "COMS" software package.

   Connect the computers RS232 extension lead to the Maintenance (MTCE) port on the front panel of the RTU and press 'RETURN' 2 or 3 times. The system prompt 'OK' should appear on the screen.

   For information on the RTU configuration and a list of the interactive words available, type **help** <return>

```
OK
OK
OK

help

The following tests are available:
DINS  - show digital input states
B-SW  - show battery switch state
AINS  - show analogues (0 to 4095)
DOUTS - operate the relays
ERASE_FLASH - erase the program!!
DIAL  - dial to RCMS Host (not on IP)

Info:  Sitecode is 003
Host phone is         07860 674623
Site phone is         07515 094950
Code Switch is set as MASTER
Modem Type is ASL 305 LAN
Time & date   17:00:30    04/01/08
OK
```

AINS display analogues using the raw A-D value (0-4095)

```
OK
ains
3    3    3    3    2    1    1    1
OK
```

B-SW show battery switch status

```
OK
b-sw 0 0 0 0 0 0 0 0 1 1 1 1 0 0 0 0 1 1 1
OK
```

DIAL instigate a dial to the Sitewatch Host (not available on IP)

DINS display Digital Input Status

```
OK
DINS
0 0 0 0 0 0 0 0     0 0 0 0 0 0 0 1     0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0     0 0 0 0 0 0 0 1     0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0     0 0 0 0 0 0 0 1     0 0 0 0 0 0 0 0 OK
OK
```

DOUTS Allows for operation of the 4 Relay Outputs (Press the corresponding relay output number on the keyboard, press once to TURN ON and again to TURN OFF.

```
OK
douts
Chan (1 to 4)? 1 ON
Chan (1 to 4)? 1 off
Chan (1 to 4)? 2 ON
Chan (1 to 4)? 2 off
Chan (1 to 4)? 3 ON
Chan (1 to 4)? 3 off
```

ERASE_FLASH erase the MIDI-8R-DC RTU program

8 - NETWORKING

1. If a large number of inputs are to be monitored at one site or if the site inputs are distributed over a wide area, a number of Sitewatch MIDI-8R-DC RTUs can be interconnected using a 4 wire RS485 local area network (LAN). One RTU at the site is defined as the 'Master' RTU and it contains the modem. All the other RTUs connected on to the master's RS485 LAN are 'Slave' RTUs and they communicate with the Sitewatch Host computer via the Master RTU and its modem. The Slave RTUs are identical to the master except that they are not fitted with a modem.

2. In order to 'Master / Slave' the MIDI-8R-DC RTUs together you must ensure that all RTUs are configured correctly, one as the Master and all others as Slaves.
   The configuration is done by code switch position, link selection and port allocation.
   The Master RTU will have Serial Port 0 configured for an RS232 interface (modem) and Serial Port 1 configured for RS485 communications.
   The Slave(s) RTU(s) will have no modem and will have Port 0 configured for RS485 communications.

   Master MIDI-8R-DC RTU

   Please note that each RTU needs a unique LAN ID, the ID is set by the code switch (SW2) on the Processor Board.

   Set the Master RTU to position "0" and the Slave RTUs (as appropriate) in order, "1", "2" or "3"

   Ensure Links LK30, LK31 and LK32 are not fitted
   Ensure Links LK34 is fitted and Link LK35 is across pins 2-3
   Modem connector is plugged into CON2
   LAN connector is plugged into CON3

   Intermediate Slave MIDI-8R-DC RTU

   Ensure Links LK30 is fitted and Links LK31 and LK32 are not.
   LAN connector is plugged into CON2

   Last Slaves MIDI-8R-DC RTU

   Ensure Links LK30 and LK32 are fitted and LK31 is not.
   LAN connector is plugged into CON2

3. Slave RTU's are commissioned in the same way as the Master RTU from the Sitewatch Host using the Master RTU as the communications link. Alarms noted by Slave RTUs are reported to the Sitewatch Host by the master RTU via the network. Failure of one or more Slave RTUs does not prevent the RS485 network from operating. A maximum of 3 Slave RTU's can be interconnected to one master RTU at one site, providing a maximum capability of 96 digital inputs, 32 analogue inputs and 16 digital outputs on one phone line.

4. The RS485 network **must** be run in 4 core cable, with individually screened twisted pairs, protected from induced noise and environmental conditions. The maximum length of the network is approximately 1000 yards or 1 kilometre.

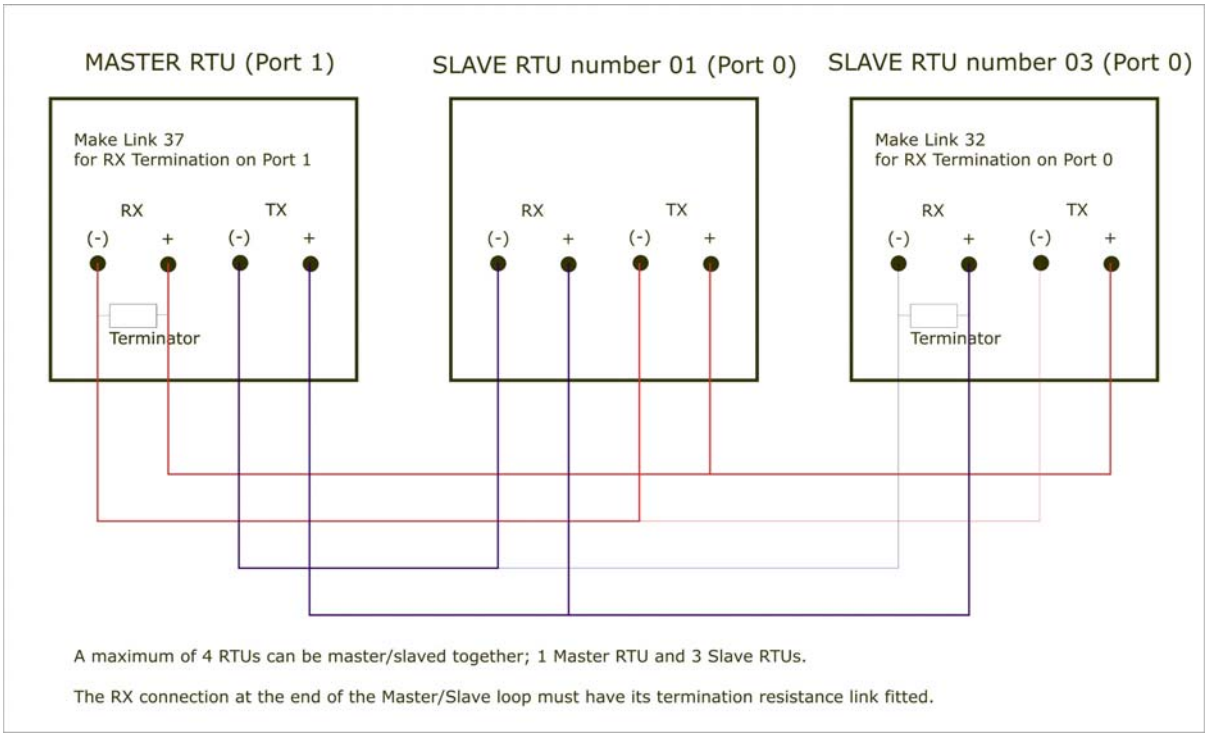
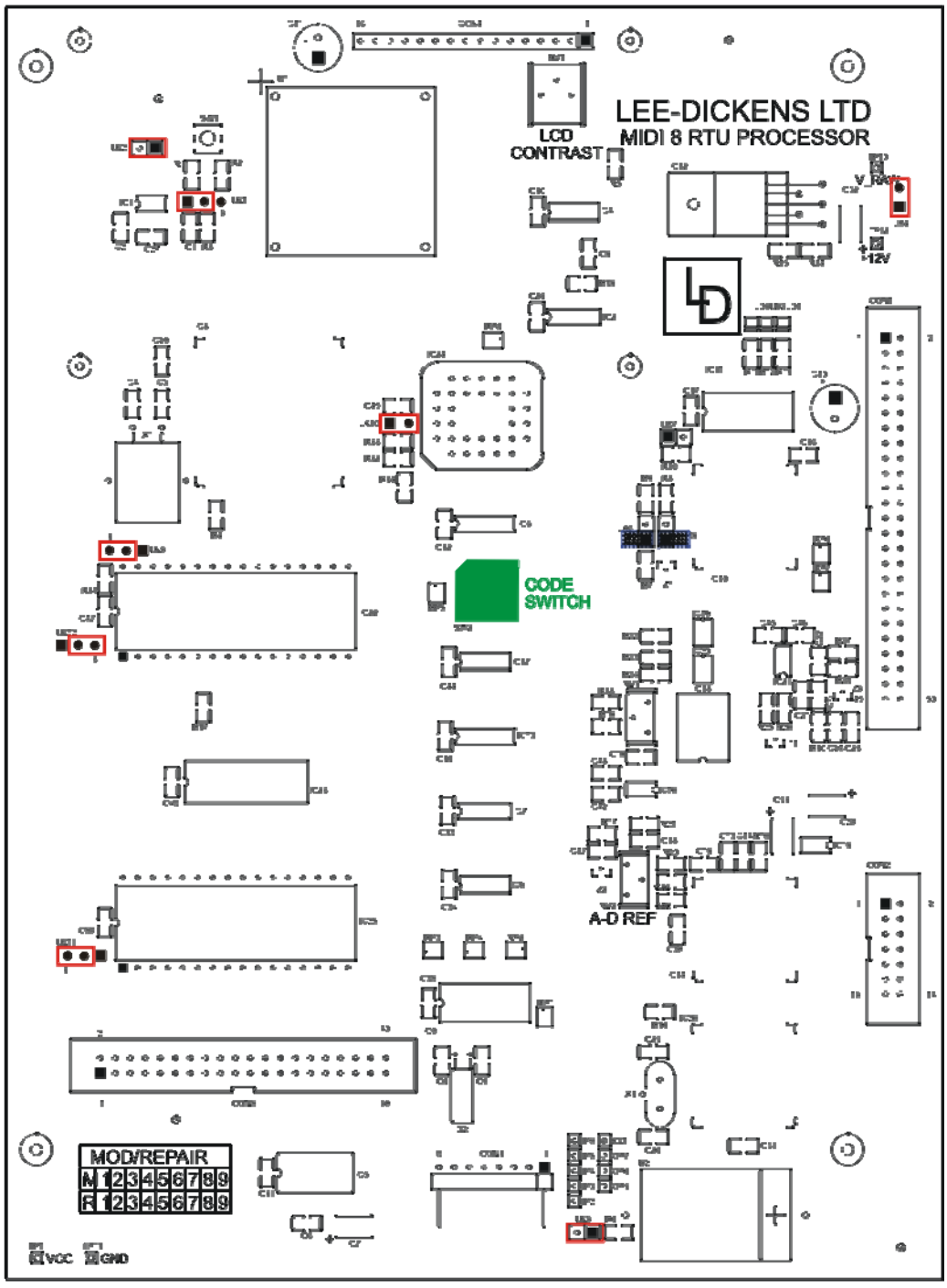


Figure 7 - Master/Slave RTU Rs485 LAN Wiring

9 – LINK CONFIGURATION GUIDE

9.1 Processor Board

Processor linking

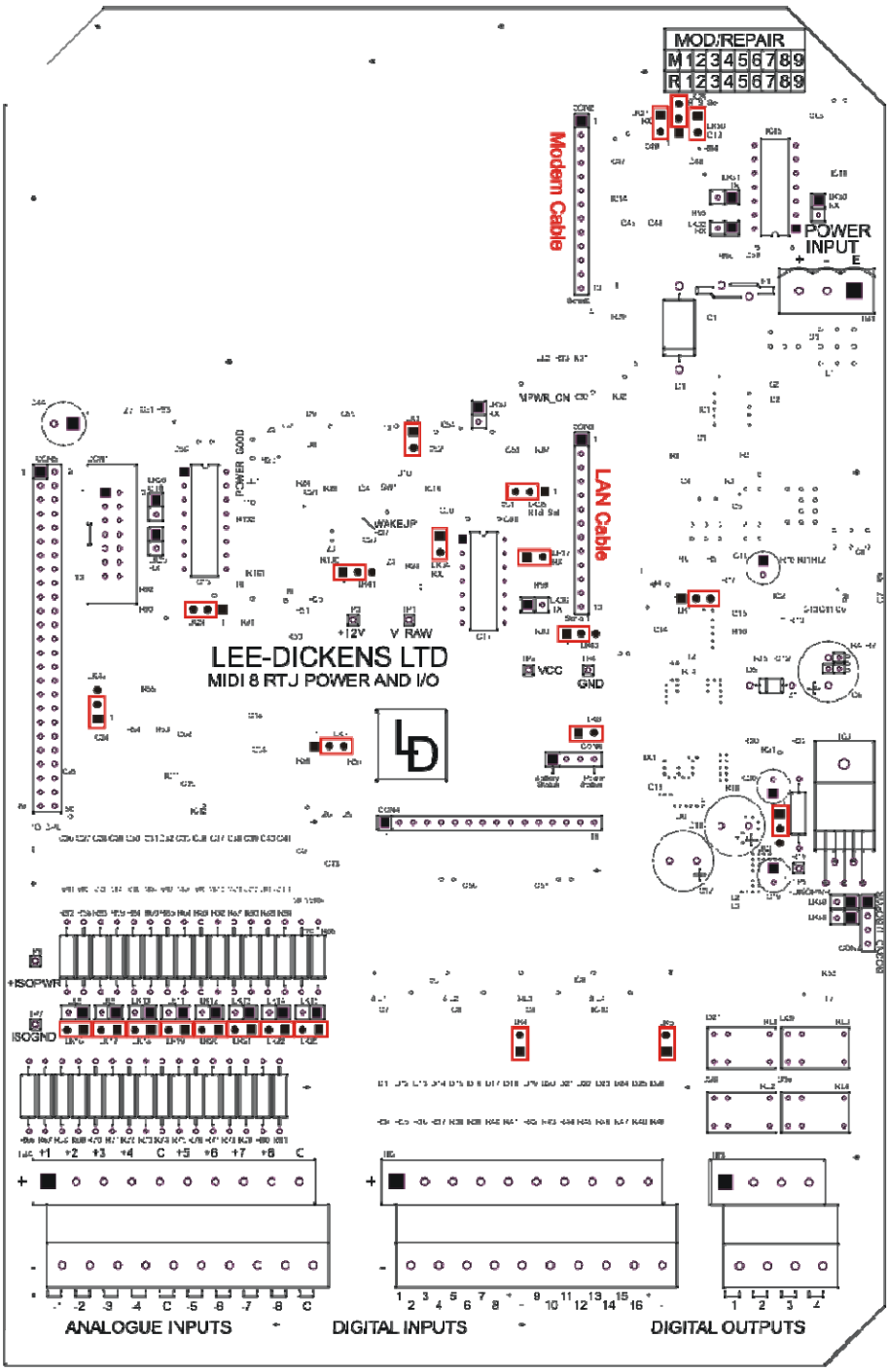


Key Link Installed

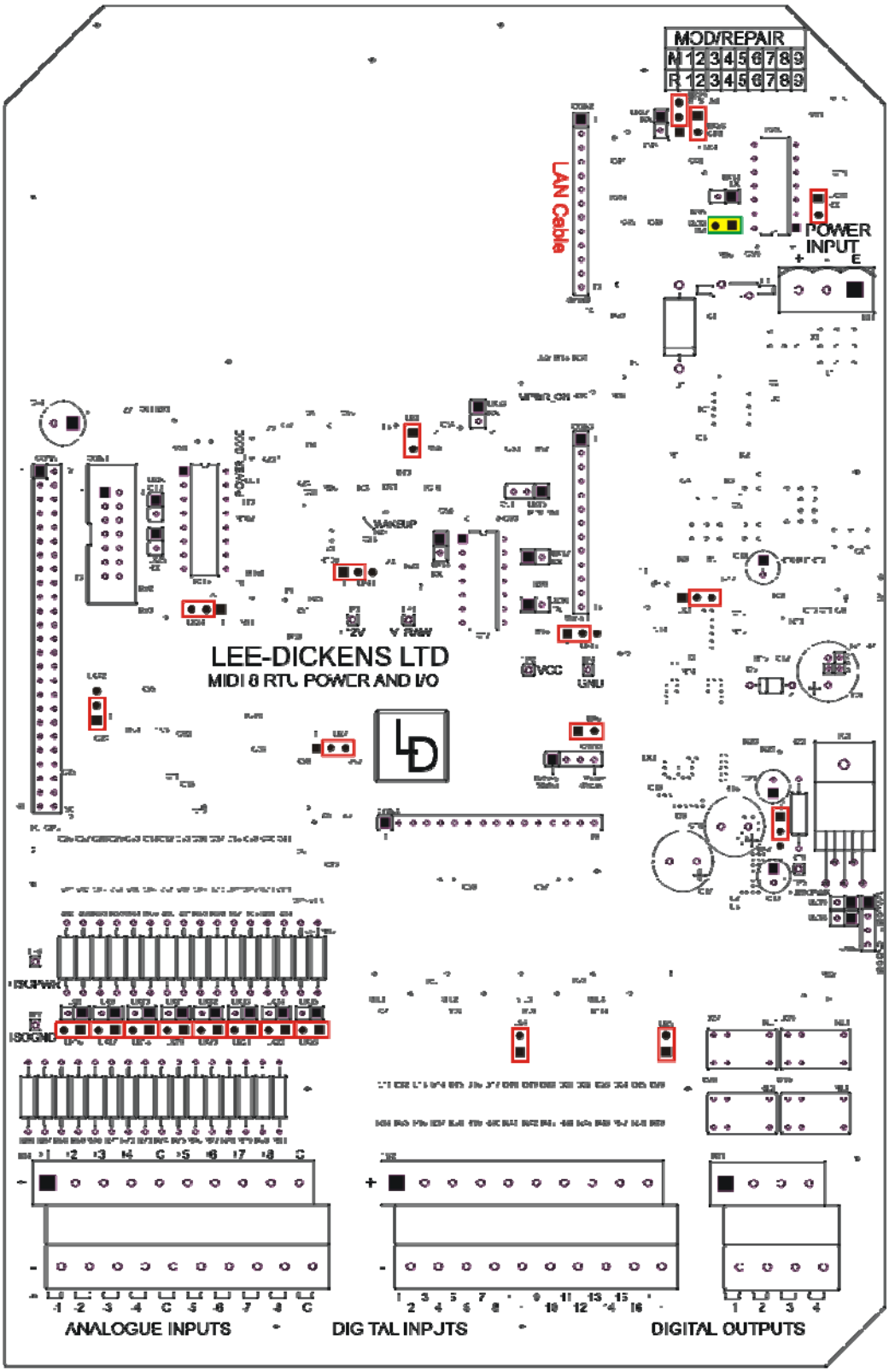
Set LAN ID

Issue 2

9.2 Power I/O Board – Master configuration



9.3 Power I/O Board – Slave Configuration



10 - FAULT FINDING

1. Sitewatch RTU's are designed to operate in harsh industrial environments. All RTUs are fully functionally tested and soak tested before despatch and, providing they are correctly installed, they should give years of trouble free service.

2. In the unlikely event of a fault, the following procedures and tests should be carried out to isolate the location of the fault. Tests should be carried out by a competent electrician or electronics technician.

3. Before starting any testing it is worth remembering that the majority of faults reported will be outside the RTU and are generally associated with power supplies, input/output devices, telephone lines or transducers.

RTU inoperative	RTU Power	LE1 on	Input/output board on indicates incoming supply is healthy
		LE1 off	Check the 12VDC voltage at the RTU input terminal, TB1.
			Check the RTU 5V Line (VCC) on the Processor Board, across Test Points TP11 and TP13
			Check Isolated power supplies on the Power I/O Board at connector TB2, (+) and (-) terminals.

RTU does not function correctly	Processor malfunction	Check operation of LEDs LD1, 2 and 3 on the processor PCB. Yellow LED pulsing at approximately 1Hz indicates normal operation. Yellow LED LD3 “off” and Red LED LD2 pulsing indicates that the RTU is in Fault Code.
		Switch off power and check that the EPROM is correctly installed in its socket.
		Check the RTU 5V Line (VCC) on the Processor Board, across Test Points TP11 and TP13
		Check links LK5 and LK6 on the processor card are not fitted.
RTU does not call Host	PSTN Modem Telephone Line	Plug the telephone handset into the line and make an outgoing call to check line quality
		Have someone call you back to the handset, check that the handset rings correctly and that the line quality is good.
	GSM Modem Sim Card	Check that the GSM modem antenna is connected Check that the DATA sim card is still active
	IP Modem	Check the Network cable connection
	Modem	For modems powered from the RS232 (port0) check that LED 2 (LE2) on the {Power I/O Board is on when the modem is dialing.
	RTU	Has the RTU been Silenced from the Host Computer? Ensure Link LK 5 (Dial Out Inhibited) is removed

RTU does not report fault conditions	Configuration	Check RTU is configured from the Host to report required alarm conditions.
	RTU	Check input linking for the digital and analogue input circuits is correct, and more than 4 mA is flowing in digital input circuits that are in the on state.
		Using the RTU LCD and Keypad, check the functioning of the input/output circuits and their calibration. (n/a for rack mounted version)
		Initiate an alarm condition and check that it is detected by the RTU LCD and reported to the Host (n/a to rack mounted version)
RTU does not report historical data	Configuration	Check that Host has configured RTU to log data, has an auto status report time included and requests logged data to be uploaded.
	RTU	Check that the RAM battery on the Processor Board is healthy and that link LK2 is fitted. (LK2 to 0V = 3VDC)
		Check operation of RTU standby battery system.
RTU in Fault Code	Configuration	Reprogram and Recommission the RTU from the Sitewatch Host computer