WARNING

This product provides powerful features that allow the contents of Radio Frequency IDentification (RFID) tags to be inspected, altered and (in some cases) permanently locked. It is the responsibility of the user to ensure that they are fully conversant with the wide range of features that are offered by tags supported by this product. No responsibility can, or will, be accepted by SIRIT Technologies for any tags that are corrupted or permanently locked through direct or indirect use of this product.

WARRANTIES

SIRIT Technologies makes no warranty of any kind with regard to the material contained in this document, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose.

SIRIT Technologies reserve the right to make changes, without notice, in the specifications and materials contained herein, and shall not be responsible for any damages (including consequences caused by reliance on the materials presented), including but not limited to typographic or arithmetic policy.

RESTRICTIONS

PRODUCT WARRANTY

This product is warranted against defects in materials and workmanship, under normal use and service, for one calendar year from the date of purchase, in accordance with SIRIT Technologies' standard terms and conditions. All goods returned under this warranty must be as new and not modified in any manner. Under such conditions SIRIT Technologies' sole responsibility shall be, at its discretion, to either repair or replace such defective products. Under no circumstances shall SIRIT Technologies be liable for any consequential direct or indirect loss of revenue or profit, caused by failure of the product.

LIFE CRITICAL APPLICATIONS

SIRIT Technologies' products are not designed, intended, authorised or warranted to be suitable for life support or other life critical applications, which could involve potential or actual risk of death, personal injury or severe property or environmental damage.

Approvals

The information below relating to approvals supersedes and replaces the relevant information within this manual and must be adhered too to maintain approvals.

FCC approval & Sato CL408/412 printer

FCC approval for the OEM-400v1.2 as fitted to the Sato CL408/412 printer has been carried out under the limited modular approval (LMA) approach in order to maintain approval the following items must be adhered to:

- The module must remain entirely unmodified by Sato Corporation and must be used as supplied.
- The external printer identification label must including the text “Contains Transmitter Module FCC ID: PR5OEM400V12.
- The power supply to the OEM400v1.2 module must be regulated to 5V±5%.
- The custom antenna supplied to Sato with the module is the only one to be used in the SATO CL408/412 printer.

Industry Canada approval & Sato CL408/412 printer

- The module must remain entirely unmodified by Sato Corporation and must be used as supplied.
- The external printer identification label must including the text “Contains Transmitter Module IC ID: 4211A-OEM40012
- The power supply to the OEM400v1.2 module must be regulated to 5V±5%.
- The custom antenna supplied to Sato with the module is the only one to be used in the SATO CL408/412 printer.

1 Product overview

1.1 Introduction

This user guide describes the features and capabilities of the OEM400, high frequency OEM board. The guide provides an overview of the hardware only, and should therefore be used in conjunction with the Smart Label Communicator (SLC) protocol and associated software guides.

Features of this product include:

- Read from and write to most leading 13.56MHz RFID tags and smart labels
- Secure firmware download capability via the serial interface
- Accepts firmware updates to support new tags in the future
- Powerful, fast serial communication protocol
- Configurable baud rate and output power
- Single +5V power supply operation
- Serial interface and power supply on single connector
- Two software controlled, board-mounted LEDs
- Operates at RS232 or TTL level
- Separate antenna connection accepts various antenna styles and sizes

1.2 Tags supported

The OEM400 product supports reading and writing (when possible) to the following tags and smart labels:

- ISO15693 compliant tags and smart labels
- Gemplus FOLIO
- Inside Technologies PicoTag
- Microchip series 300
- Omron V720
- Philips Semiconductors I.CODE
- Texas Instruments Tag-it

Note that the Gemplus FOLIO and Omron V720 tags both use silicon from Philips Semiconductors and will therefore be reported as a Philips I.CODE tag.

1.3 Warranty exception

The following components may be added, removed and/or modified without exceeding the terms and conditions of the product warranty:

- Output selection resistors: R63, R64 and R65
- Baud rate setting pads: SB1 and SB2

2 First time operation

2.1 Introduction

This section is designed to provided a step-by-step guide to operating the OEM400 product for the first time. It is recommended that initial set-up and test be performed using a personal computer and regulated power supply. Before reading the instructions below, it is suggested that the following equipment will be required:

- OEM400 product
- Suitable external antenna, it is recommended that the ACC285 antenna be used
- Regulated, bench power supply
- PC running Windows 95/98/00™ with a spare communications port
- Standard 9-pin D-type male to female extension cable
- ACC158 D-type to Molex connector (see section 4.4 for a wiring diagram)
- Selection of high frequency tags
- SIRIT Software Support Suite CD-ROM

All component references made in this section can be identified in the diagrams provided in section 4.3

2.2 Power and serial connections

The OEM400 product requires a single source of external power, which should be specified at +5V (± 0.2V) with less than 50mV ripple. At most, the board will draw 210mA and therefore a 250mA supply is recommended. Power is fed to the board via a single 10-pin Molex connector (CN2), part number 53261-1090. The mating part for this connector is Molex part 51021-1000. This connector is also used for the send and receive lines for serial communications.

Table 2-1 shows the pin allocation for the Molex connector.

Pin	Name	Description
1	GND	Ground, 0V
2	OP2	Open collector output 2
3	OP1	Open collector output 1
4	IP2	Input 2, TTL level
5	IP1	Input 1, TTL level
6	TXD	Board transmit line (serial out), RS232 levels
7	EN	Wake-up input line, +5V on, 0V off
8	RXD	Board receive line (serial in), RS232 levels
9	5V	+5V DC
10	NIL	No connection should be made on this pin

Table 2-1 : Pin allocations

IMPORTANT NOTE: There is no built-in protection for over voltage or incorrect polarity setting on this product. Damage to the product under such conditions is not covered under the standard product warranty.

Serial transmit and receive lines should be connected to pins 6 and 8 respectively. The OEM400 product can communicate at a variety of baud rates (see section 2.4), however, port setting should be set as follows:

- 8 data bits, 1 stop bit, no parity, no handshaking

The OEM400 product is shipped with a factory default RS232 communication interface, however, TTL level communications is also possible. To communicate with the product at TTL levels, two 0603 0 ohm resistors should be soldered on pads R136 and R137 on the underside of the board. See section 4.3 for the location of these pads.

Note that sending RS232 level signals to an OEM400 product, when configured to receive TTL level signals, may result in damage to the board.

2.3 Antenna connection

A 2-pin Leotronics connector (CN1) is provided on the board for connection of an external antenna. The part number for this connector is 2010s02000, with mating parts as follows:

- 24-26 AWG wire, maximum insulation of 1.56mm: part 2033tbp000
- 28-30 AWG wire, maximum insulation of 1.40mm: part 2033tbp00v1

The OEM400 product requires an antenna tuned to resonance at 13.56MHz and should present a 50ohm load at this frequency. A return loss of (S11) of –20db or greater is preferred for reliable operation. The loaded Q of the antenna should be in the range 10 to 25 in normal operation.

Whilst performing initial test and set-up procedures it is recommended that the standard ACC285 antenna be used. This will be provided with a pre-wired Leotronics connector.

Note that the OEM400 does not have an integral antenna. An external antenna must be connected to interact with tags, however, the board will power with or without an antenna present. It is recommended that power be removed from the board when adding or removing an external antenna.

2.4 Baud rate settings

The OEM400 product may be configured to operate at one of four baud rates. These are selectable using two solder pads located on the rear of the board. These are named SB1 and SB2.

Unless specifically documented, the OEM400 is factory set to 57,600 baud.

Table 2-2 shows the states of solder pads 1 and 2, used to set the baud rate.

Baud rate	Pad SB1	Pad SB2	Pads SB3-8
57,600	Open	Open	Not used
38,400	Open	Closed	Not used
19,200	Closed	Open	Not used
9,600	Closed	Closed	Not used

Table 2-2 : Solder pad settings for baud rate

Connection between pads should be made using an 0603 0 ohm resistor, however, the pads are located close enough that they may be bridged with solder alone.

2.5 Digital I/O

Digital I/O is provided on the OEM400 product through pins 2 to 5 (see Table 2-1). Outputs are open collector, and inputs are via a 100K pull-up resistor.

For details of setting and detecting the state of the digital I/O, please refer to the SLC Protocol documentation.

2.6 Output power settings

The output power fed to the attached antenna may be set using a combination of three resistor values (R63-R65) located on the top-side of the board. All resistors are 0805 size and should be specified to 5% 0.1W.

Output power levels are achieved by adjusting the values of the three resistors in accordance with the data provided in Table 2-3.

Attenuation	R63 Value	R64 Value	R65 Value
0 db	100k	0R	Not fitted
- 1db	910R	5R6	910R
- 3db	300R	18R	300R
- 6db	150R	36R	150R
- 9db	100R	62R	100R
- 10db	100R	68R	100R

Table 2-3 : Resistor settings for adjusting output power

Unless specifically documented, the OEM400 product is factory set to 0 db.

2.7 Installing and loading the SLC test software

In order to determine the correct operation of the OEM400 product, it is recommended that the SLC test software be installed. This can be installed from the Autorun™ menu on the Software Support Suite CD-ROM, or can be started manually by running the setup.exe program from the '\SLC_test' directory. Follow the on-screen prompts, which will guide you through the installation of the software.

Once completed, the 'SLC test software' icon will be available in a SIRIT folder on the Windows™ Start Menu. Clicking on this icon will load the software and automatically show the commands screen, shown in Figure 2-1.

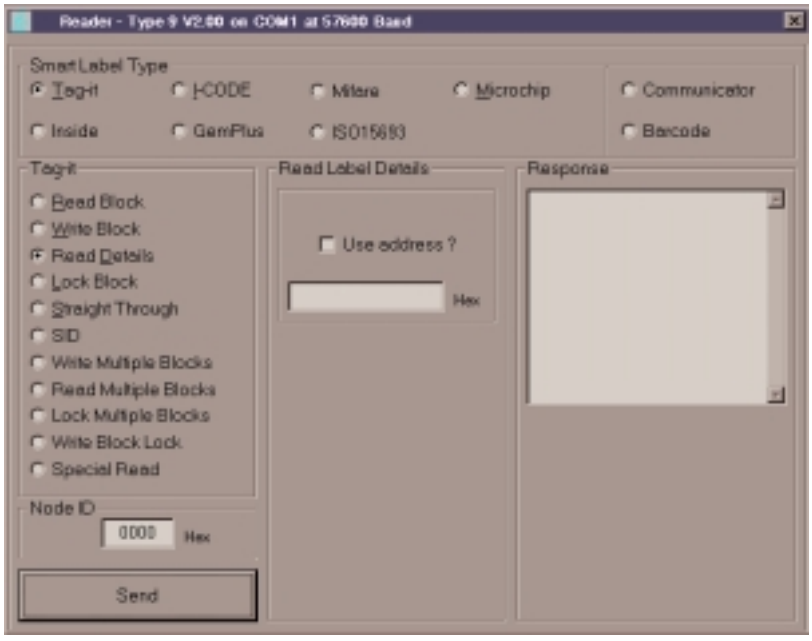


Figure2-1 : SLC test software, commands screen

The title bar of the commands screen should read "Searching for a reader". At this point, the reader should be powered.

2.8 Powering for the first time

When power is supplied to the reader from an off state, both on-board LEDs D5 and D6 will illuminate. Less than one second after power is applied, D5 will turn off and D6 will remain illuminated to indicate that power is present. If the power supply is able to monitor current, a draw of 70mA should be observed (when operating at RS232 levels).

Returning back to the SLC test software, the title bar of the commands screen should now read “Reader – Type 9 V2.00 on COM1 at 57600 Baud” or similar, depending on the port and parameters that have been used. If this message is not displayed, please refer to section 5 in order to determine the cause of the problem.

2.9 Set-up and test

Assuming that the board is powered and the version string has been detected and displayed in the title bar, the next step is to ensure that the board is correctly reading tags. The simplest method of determining the performance of the product is to use the reader test function (Figure 2-2) of the SLC test software. This is available from the Options menu.

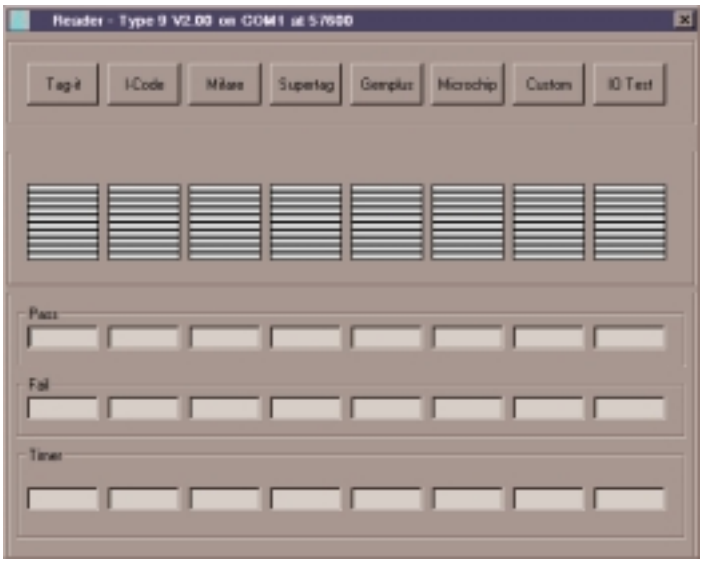


Figure 2-2 : SLC test software, reader test screen

The reader test is a convenient method of assessing the correct operation and performance of a OEM400 product.

To enable a test of particular tag, select the button of the tag you wish to test, which will then become depressed. When no tag is present, the ‘Fail’ counter will increment at a rate of approximately ten counts per second and the timer will begin. To test the read range, position a tag (of the type selected) directly above the antenna. The ‘Pass’ counter will now increment and the horizontal bar display will begin to turn from red to green. The read range of the product can now be tested by moving the tag slowly away from the antenna.

Ranges for supported tags can be found in section 4.2.

3 Downloading firmware

3.1 Introduction

The OEM400 product supports the downloading of firmware updates to flash memory via the serial interface. Firmware updates may be provided for this product for regular maintenance, support for new tags types and feature enhancements. Note that firmware download files cannot be created and downloaded by the user.

To use the secure download facility, you will need a copy of the OEM400_FMR.exe program, the installation for which can be found in the '\utility\firmware' directory on the Software Support Suite CD-ROM. In addition, you will also require a copy of the latest firmware release, which can be found in the same directory. The firmware file will have a .frm extension and will be in the format OEM400[version number].fmw.

To install the firmware downloader, execute the setup.exe file located in the directory specified above. The installer will allow selection of an installation directory for the software. Once the installation has completed, an 'SLC Firmware Downloader' icon will be available in a SIRIT folder on the Windows™ Start Menu. Upon selecting this icon, you will be presented with the screen shown in Figure 3-1.

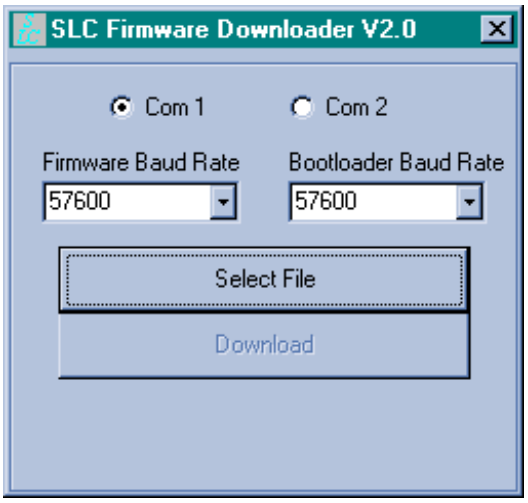


Figure 3-1 : Firmware downloader, main screen

3.2 Selecting the communications port

Both the 'Firmware Baud Rate' and 'Bootloader Baud Rate' parameters should be set to the hardware-programmed baud rate of the board (see section 2.4).

3.3 Selecting the firmware file and downloading

Pressing the 'Select File' button will enable selection of the firmware (.fmw) file. Navigate to the directory containing the firmware file you wish to download, select the filename from the file list and press the OK button.

If the file load was successful, the 'Download' button will now be enabled. Pressing this button will initiate the download process. A blue progress bar will show the status of the download.

3.4 Forcing the product into Bootloader mode

If the OEM400 product has become locked and will not automatically enter Bootloader mode, i.e. the download software does work, bridging pads PC1 and PC2 on the board using a cable (or similar) link will force the board firmware into the Bootloader mode when powered.

Note that once the board has powered the bridge should be removed.

4 Technical specifications

4.1 Introduction

This section is a reference guide for the technical features of the product. More detailed information about the operation of the OEM400 product can be found in section 2.

4.2 Hardware specifications

Electrical specifications		
Processor	*Type*	Motorola MC68HC908GP32
	Memory	32kbytes of flash programmable memory, 512bytes of RAM
	Features	Supports flash upgrading of firmware through the serial interface
Communications	*Protocol*	Serial packet-based protocol with error detection
	Baud rates	Hardware selectable between 9,600 and 57,600 baud
	Structure	8 data bits, 1 stop bit, no parity, no handshaking
	Signal	Hardware selectable between RS232 (default) or TTL
	Interface	Pins 6 and 8 of Molex connector (mating part 51021-1000)
Power supply	*Voltage*	+5V ±0.2V DC, with less than 50mV ripple
	Input current	250mA minimum
	Quiescent current	90mA
	Active current	210mA
Digital I/O	*On-board LEDs*	Two surface-mount LEDs under software control
	Inputs	2 digital inputs on pins 4 and 5 at TTL level
	Outputs	2 digital outputs on pins 2 and 3
Antenna	*Type*	Tuned to 13.56MHz, 50ohm load, loaded Q range of 10 to 25
	RF power	User configurable. Unattenuated, 100mW minimum, 120mW typical
	Frequency	13.56MHz
	Notes	A standard OEM antenna (ACC285) is available for this product
Tag read/write ranges (using ACC285 antenna)		
Philips I.CODE (75 x 45mm)	*Read*	115mm
	Write	110mm
TI Tag-it (75 x 45mm)	*Read*	125mm
	Write	80mm
Inside PicoTag (75 x 45mm)	*AC Select*	90mm
	Write	90mm
Microchip s300 (53 x 53mm)	*Read*	105mm
	Write	Read only tag
Mechanical and environmental specifications		
Dimensions	*Board outline*	(L) 70.00 x (W) 51.50 x (D) 8.50mm
	Component height	Top side: 4.80mm, under side: 2.10mm
	Mounting holes	4 corner-mounted holes of 2.80mm diameter
Weight	*Without antenna*	21g
Temperature	*Storage*	-40ºC to +85ºC
	Operating	-30ºC to +70ºC
	Relative humidity	80%
Approvals		
This product will be approved for EN300 330, testing to EN301 489.		

4.3 Component locations

Figures 4-1 and 4-2 show the position of components referenced in this document.

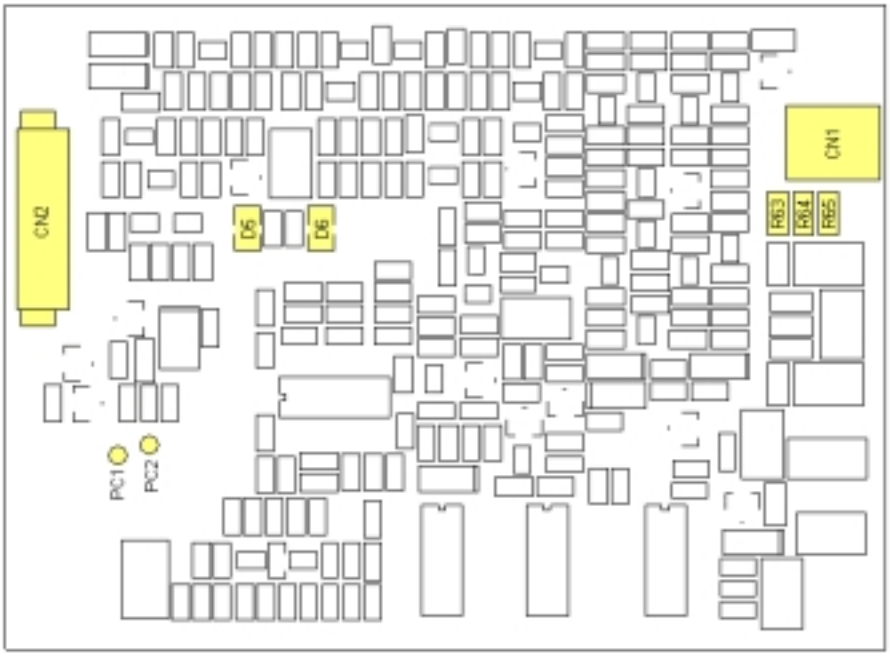


Figure 4-1 : Component locations, upper side

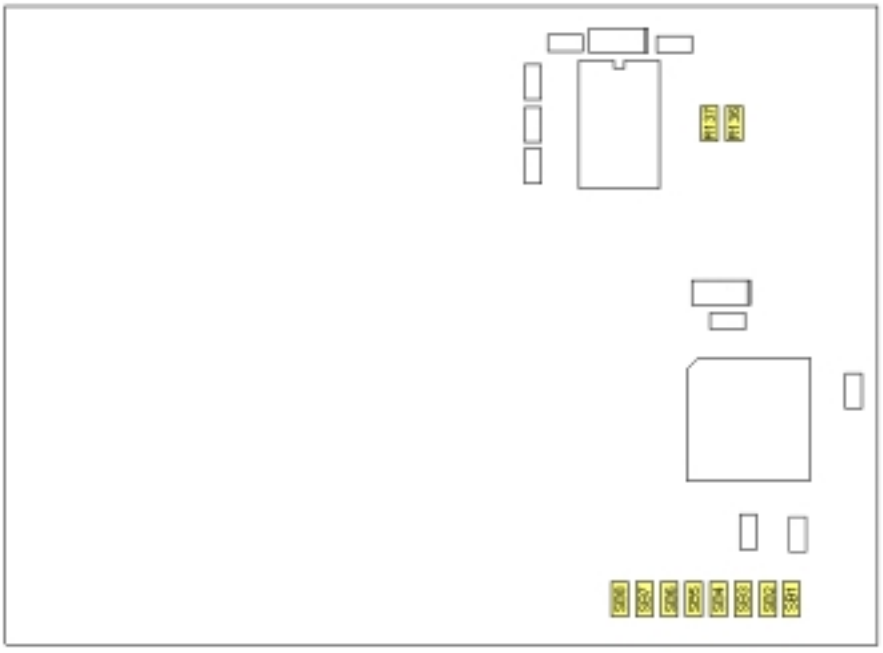
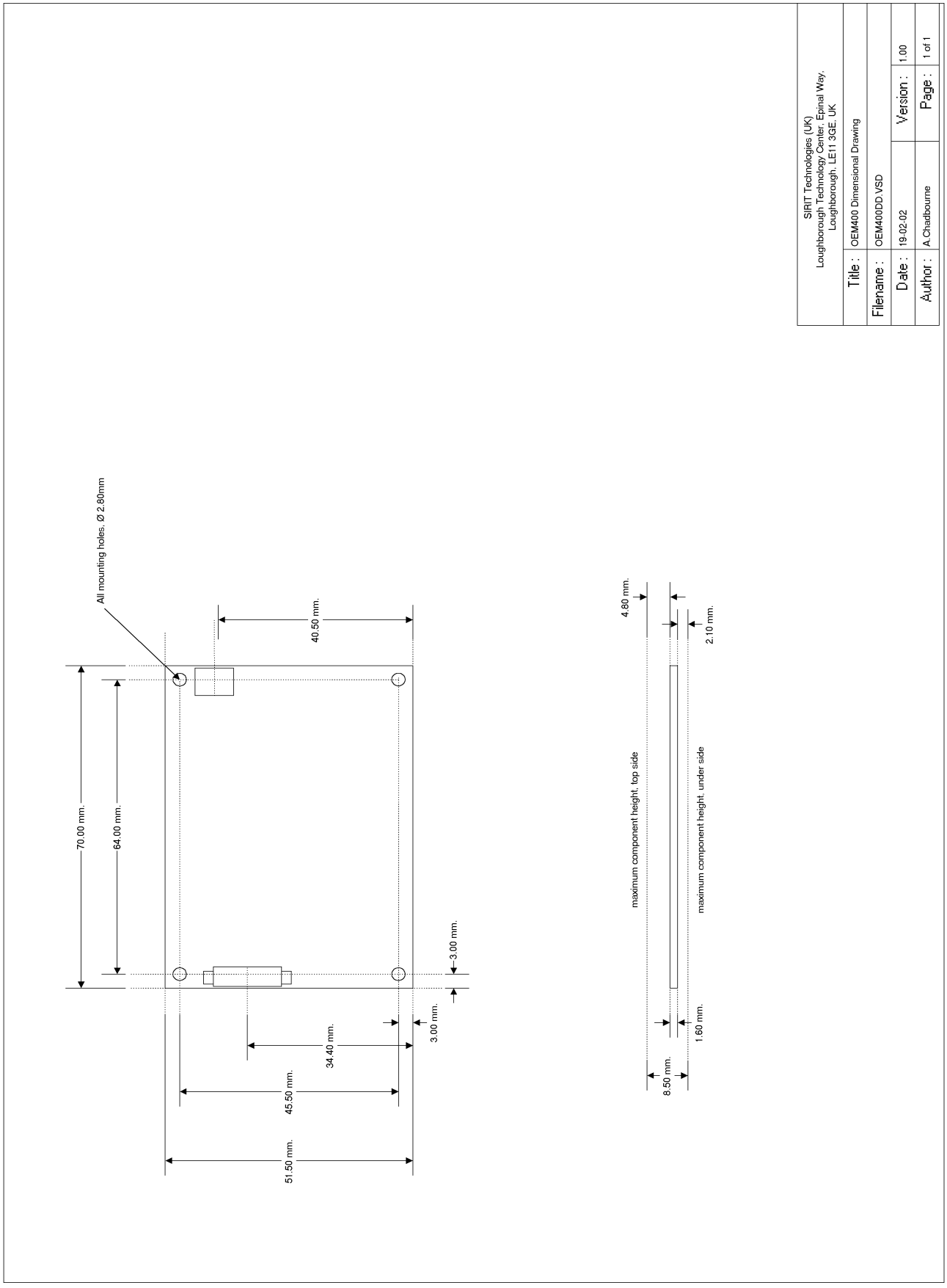


Figure 4-2 : Component locations, bottom side

4.4 Board dimensions



4.5 Wiring diagram for D-Type connector

The OEM400 product can be connected directly to a standard 9-pin, D-Type, RS232 using the wiring diagram provided below (Figure 4-3).

Note that pin 7 of the connector (wake-up) is permanently connected to the +5V supply unless required.

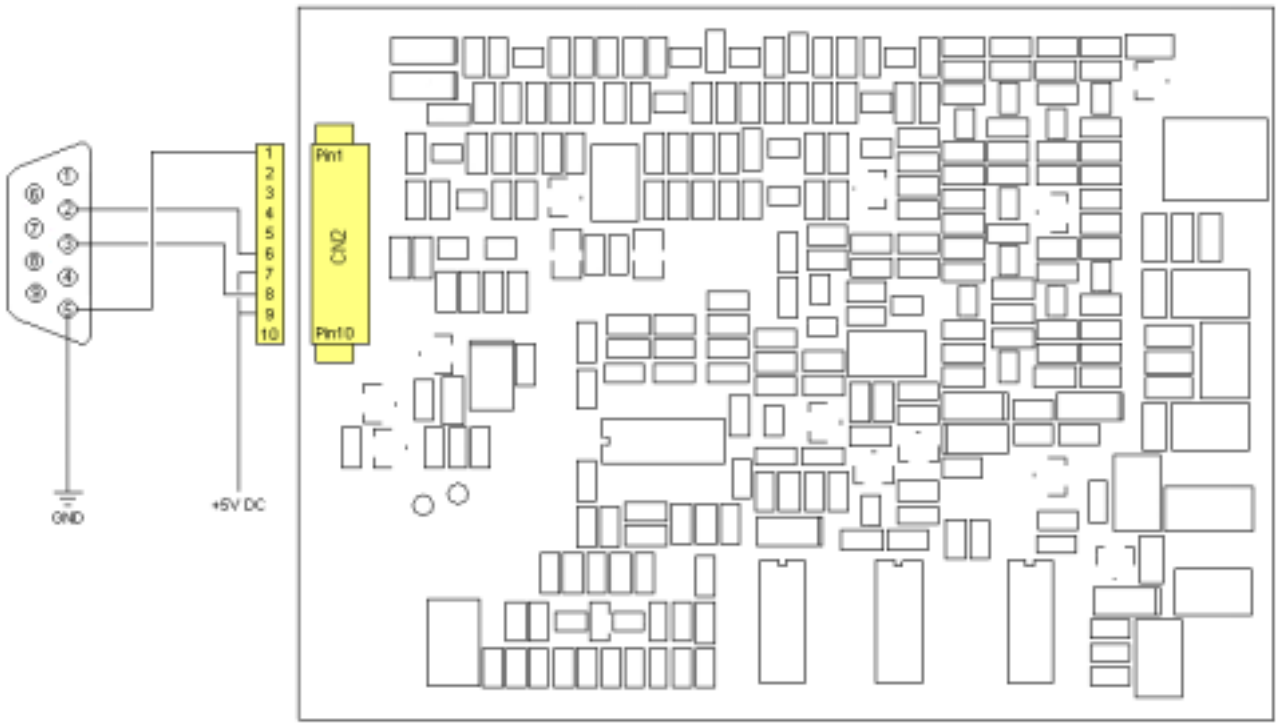


Figure 4-3 : D-Type wiring diagram

5 Fault diagnosis

5.1 Introduction

The following examples may be used to diagnose potential problems with the OEM400 product. If there are still problems with the board, please contact our technical support department.

Q. The board LEDs do not illuminate on power-on.
Check that the connector is wired correctly (see section 4.5) and that the wake-up pin (pin 7) is hard-wired to the +5V line, unless it is being used as a wake-up line. If the LEDs are still not illuminated then follow the download instructions in section 4 to download the latest firmware file.

Q. The board communicates but will not read tags.
Check that the antenna connection is secure and that the wiring is in good condition. If possible, try replacing the antenna with another and try again. Also ensure that the tag is supported by the reader (see section 1) and check that the tag is operational – it is best to try a selection of tags.

Q. The board powers but will not communicate.
Check that all wiring to the connector is secure and check the lines using a continuity tester. When in any doubt about communications, always use the SLC test software to help diagnose problems. If using a Windows™ system then ensure that no other application (PDA synchronizer, etc.) is using the COM port. Also check that the baud rate of the hardware (see section 2.4) is the same as that in the software.

Q. The board reports random data from the tag and will only detect Microchip tags.
This problem can occur when a noisy power supply is used or the antenna is not operating correctly, most likely a combination of the two. Follow the guidelines in section 2.2 to ensure that a suitable power supply is used.

Q. The read range is significantly less than the documented ranges.
Either the antenna is not operating correctly, or the output power pins have been adjusted incorrectly. Check the values of the components as specified in section 2.5 and replace the antenna.

Q. The board opens communications but reports random data.
Check that the baud rate is correct and that the communication settings for the serial type (TTL or RS232) is correct, see section 2.2.