Levelling LED Display

User manual

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Version history

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17.07.2003	0.1	SS	First version for MVLLD prototype version 0.1.

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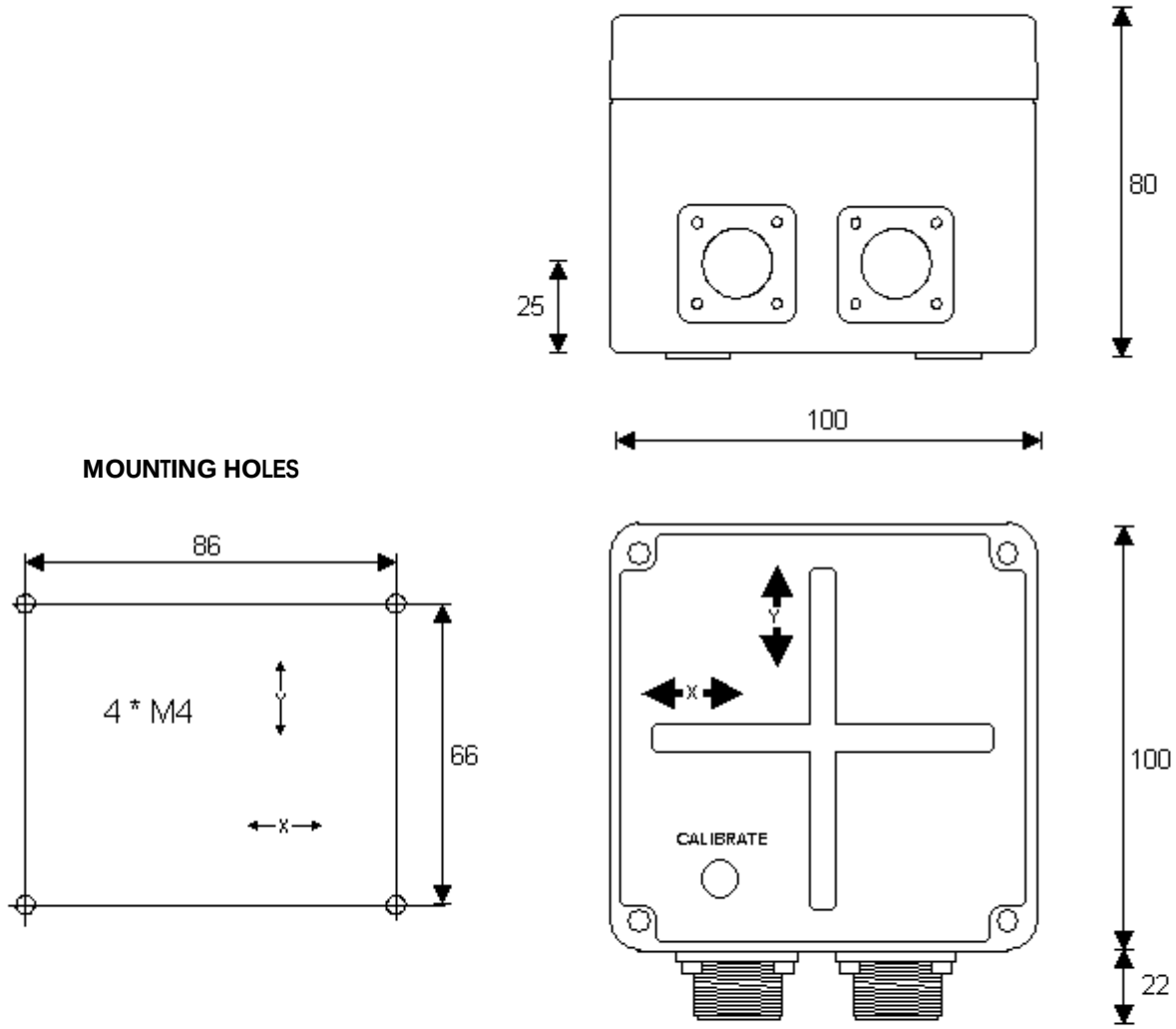
1. Introduction

MVLLD (Multivisions Levelling LED Display) is a simple visual indicator for showing level. It is capable of reading angular information from CAN bus or RS232. The standard product is designed to be used with an MVINC-CO-2 dual axis inclinometer module or the LVS series of tilt sensor modules. The LED display module has two 20 red LED rows in a cross shape configuration with one green LED in the middle. A push button is used for calibration of the display. The display's LED pattern corresponds with the inclinometer module's 2 measurement axes. Each red LED represents an error of either 0.1, 1 or 10 degrees depending on the scaling selected during calibration via the RS232 connection.

The module includes RS-232 and CAN bus interfaces for data transfer. Currently the module supports CANopen protocol on the CAN bus. The standard module includes the CAN bus in the external connectors, the RS-232 is an option, which can be supplied on request.

Figure 1.Standard casing for module.

2. Mechanical dimensions



All dimensions in millimeters

Figure 2. Mechanical dimensions

3. Electrical connections

3.1 Module External Connectors

The module has two standard four pin MIL 5015- style connectors for power supply and CAN interface.

Connector type: C3102E14S-2P-F80.

Mating connector:

Pin	Description
A	+24 V
B	GND
C	CAN HI
D	CAN LO

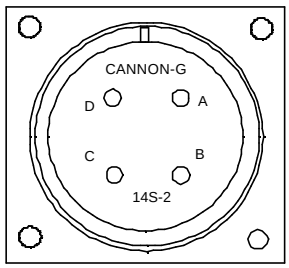


Figure 3. Module connector pinout

3.1.1 Connecting the module to an inclinometer

The module is connected to an inclinometer using a straight 4-pin cable. Either one of the two available connectors can be used for connecting the cable. A termination resistor must be connected to the other (empty) connector. Cables (for any length) and termination resistors can be purchased from Multivisions.

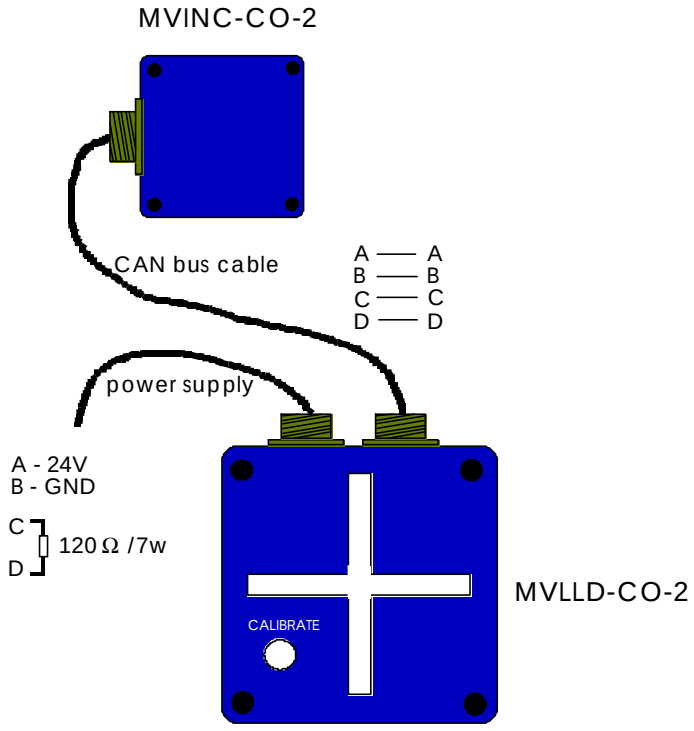


Figure 4. MVLLD installation with MVINC-CO-2

3.2 Connector J17:RS-232

The connector is located inside the housing. The serial port is used in the standard module for debug purposes, upon request the signals can be connected to the external connectors.

The module includes RS-232 compatible serial port. Instructions for building a programming cable are given in figure 5.

Pin	Description
1	NC
2	RxD
3	GND
4	GND
5	TxD
6	NC

NC = Not Connected

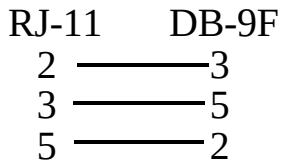


Figure 5. Cable connections for a programming cable

4. Serial interface

The serial commands can be typed directly to the terminal using keyboard. For example, typing “#RS!” and pressing “Enter” prints out the current module's settings.

4.1 Bootloader

The module includes a bootloader software, which can be used to upgrade the module application software.

How to get to bootloader :

- connect RS-232 cable between J1 and a PC
- start a terminal program on the PC. Set terminal settings to following:

Baud rate	115200
Data bits	8
Parity	none
Stop bits	1
Handshaking	XON/XOFF

NOTE: it is essential for the bootloader that XON/XOFF -handshaking is used, because the bootloader uses it for serial buffer handling.

- Press and hold down the keyboard key “d”.
- connect power to the module
- now the bootloader software download request should be shown...

```
sr-ldr 1.3-5mv
Send S-Record...
```

Send the new application as a text file (Motorola S19 file). For example, with a terminal program Tera Term Pro, select menu 'File', then 'Send file' and select the file from the list (mvlld.elf.S). After the download is complete, the bootloader starts the new application.

5. CANopen interface

The MVLLD module includes a proprietary device profile. The basic CANopen communication conforms to the CiA draft standard 301, version 4.02.

5.1 Object dictionary

Object dictionary of MVLLD is shown in table 1. Object dictionary entries in device profile DS-410 range (6000h ->) are not described in full detail, only the objects that need further explanation are described there. A full explanation of the device profile specific variables can be found in the device profile documentation [2].

Table 1. Object dictionary of MVLLD

Index (hex)	Object	Type	Access	M/O[1]	Comment
1000	Device type	UNSIGNED32	ro	M (DS-301)	
1001	Error register	UNSIGNED8	ro	M (DS-301)	
1005	cob-id-sync	UNSIGNED32	rw	O	
1010	Store parameters	UNSIGNED32	rw	O	
1011	Restore default parameters	UNSIGNED32	rw	O	
1016	Heardbeat consumer time	UNSIGNED32	rw	O	
1017	Heartbeat producer time	UNSIGNED16	rw	O	
1018	Identity	RECORD	ro	M (DS-301)	
2000	Longitudal angle (X-axis)	INTEGER16	rw	-	
2001	Latitudal angle (Y-axis)	INTEGER16	ro	-	

DS-301 = mandatory by CiA DS-301 CANopen device profile

5.2 Default PDO mapping

The module has the following default PDO mapping:

Receive PDO

PDO #	Objects	Object names	Comments
1	2000	Longitudal angle	
	2001	Latitudal angle	

1 Mandatory / Optional, defines whether the variable is defined as mandatory or optional in the DS-301 device profile. The operating mode or profile is mentioned with the mandatory variables.

5.3 CANopen features

The module includes the **heartbeat** protocol for monitoring the module. The object 1017 (Heartbeat producer time) sets the heartbeat message transmission interval in milliseconds. The minimum interval is 10 ms, and the maximum is limited by the object to 65 s (65535 ms). When the heartbeat producer time is set, the module will immediately start sending the heartbeat messages indicating the module state.

Communication parameters can be changed using SDO transfer, including PDO ID, transmission type and event timer values. The inhibit time is not implemented. The PDO mapping cannot be changed, it is permanently set to the default mapping. The module includes EEPROM-based storage for the module parameters, and the **communication parameters can be stored** on the EEPROM array using the object 1010. Also application parameters can be stored by using the subindex 2 when writing to the object 1010. This saves the objects 6000, 6011 and 6021 values. Default parameters for the communication parameters can be restored by using the object 1011. The default parameters are:

- PDO ID according to the default PDO ID allocation (0x180 + node id)
- PDO transmission type 1
- PDO event timer 0

6. References

1.	CAN in Automation; CANopen, Application Layer and Communication Profile; CiA draft standard 301, Version 4.02