



ZED GLOBAL SYSTEM: Interface Unit

USER MANUAL - SUPPLEMENT

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This document applies to the ZED Global Tunnel Guidance System

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1. INTRODUCTION

The Interface Unit is a system unit designed to interface to a number of electronic Theodolites/Total Stations. It supplies the necessary power to the Total Station and communicates with it over its serial data link. Software within the Interface Unit can also when configured to control/move the Total Station.

There are two types of Interface Units available.

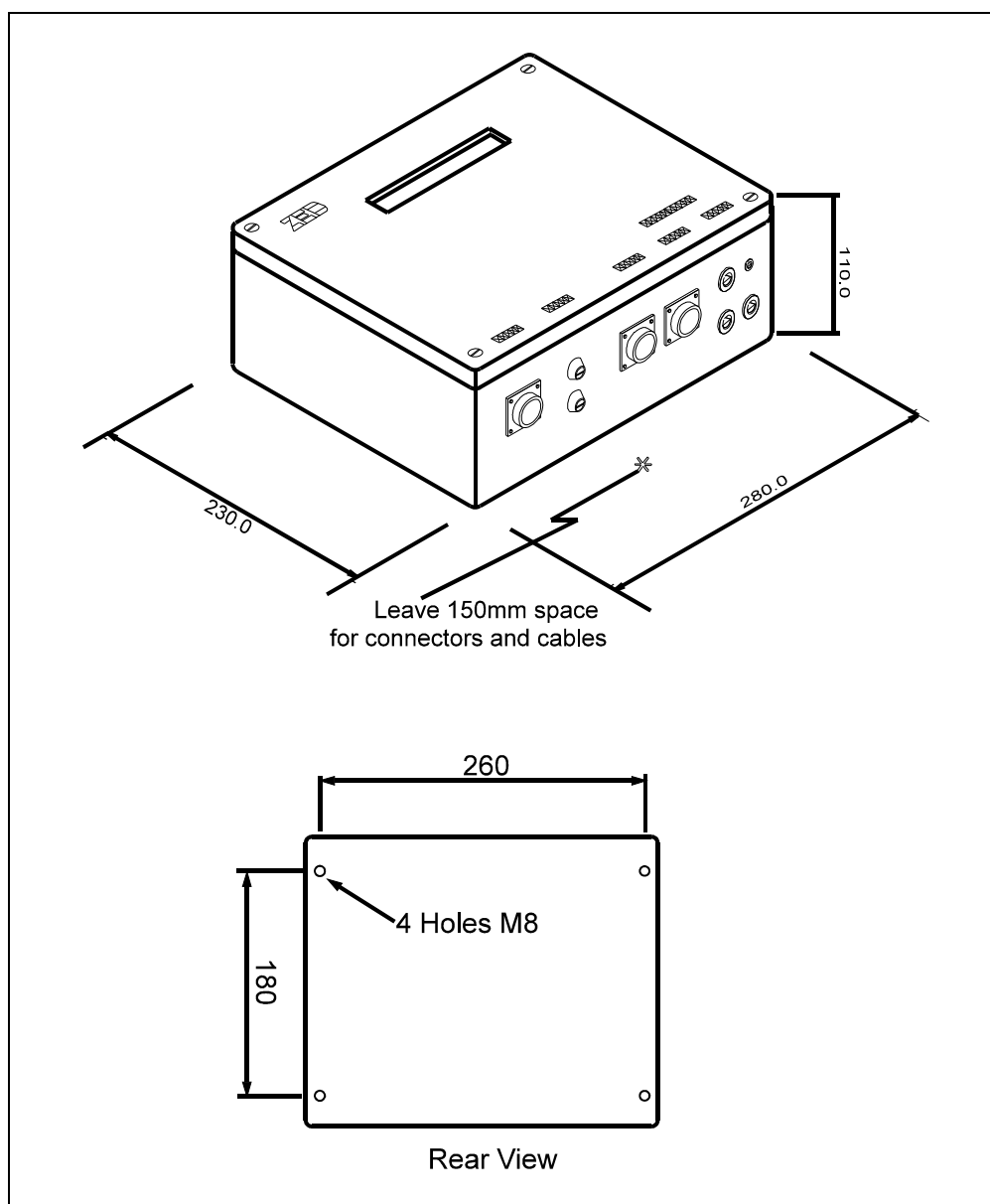
The Standard Unit - communicates and sends its data to the rest of the ZED Guidance system over a dedicated cable connection between itself and the PSU/Junction Box.

The Radio Interface Unit - communicates and sends its data to the rest of the ZED Guidance system over a radio link itself and another unit called a Radio Modem Unit.

1.1. MOUNTING THE UNITS

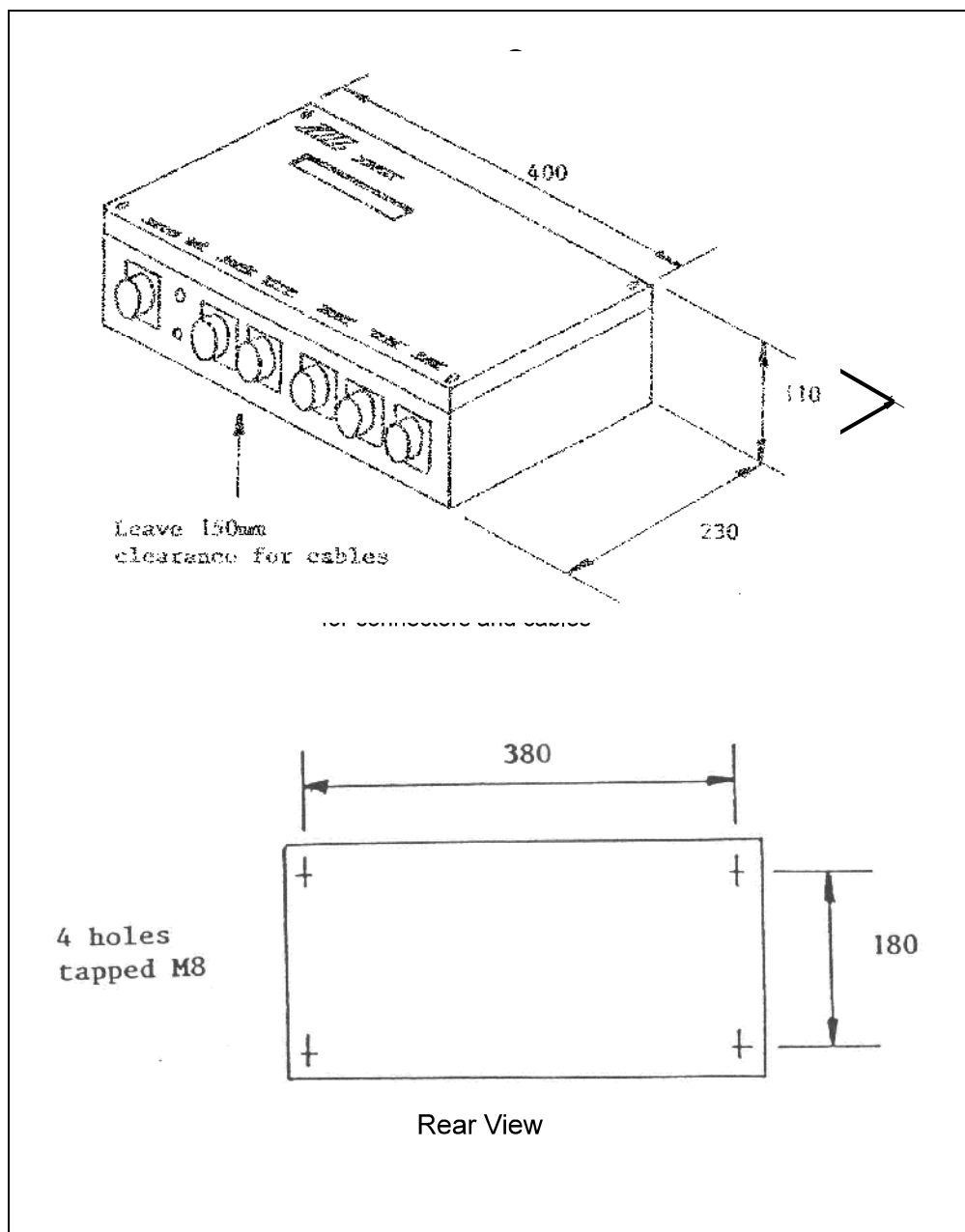
1.1.1. STANDARD INTERFACE UNIT

The Interface Unit is normally mounted on the laser platform attached to the tunnel wall. No special mounting arrangements are required although it should be fitted, so that the display of the unit is visible when the laser alignment is adjusted or checked. Since this unit is mounted on the fixed tunnel wall and it is connected to the PSU/Junction Box on the TBM care must be taken that the interconnecting cable is payed out as the TBM advances away from the laser.



1.1.2. RADIO INTERFACE UNIT

The Radio Interface Unit is normally mounted on the laser platform attached to the tunnel wall. No special mounting arrangements are required although it should be fitted, so that the display of the unit is visible when the laser alignment is adjusted or checked.



2. USING THE INTERFACE UNIT

GENERAL

The unit is normally mounted adjacent to the laser and can allow a laser-theodolite to be connected directly to the ZED system. In normal use access to the Interface Unit is only required when the laser is moved and the laser survey data is updated. This data can be entered using the PC in the office or it can be loaded into the laser-theodolite or Processor Display Unit.

Before the ZED system can be put into operation it is necessary to check that the Interface Unit is configured to suit the type of laser that is to be used. It is possible to check the configuration in the following way :

Apply power to the unit and observe the display.

The first display shows the program version e.g. I/F ZED 260 V3.15

The second display indicates if a laser theodolite has been selected.

The third display is the normal rolling display showing laser survey data.

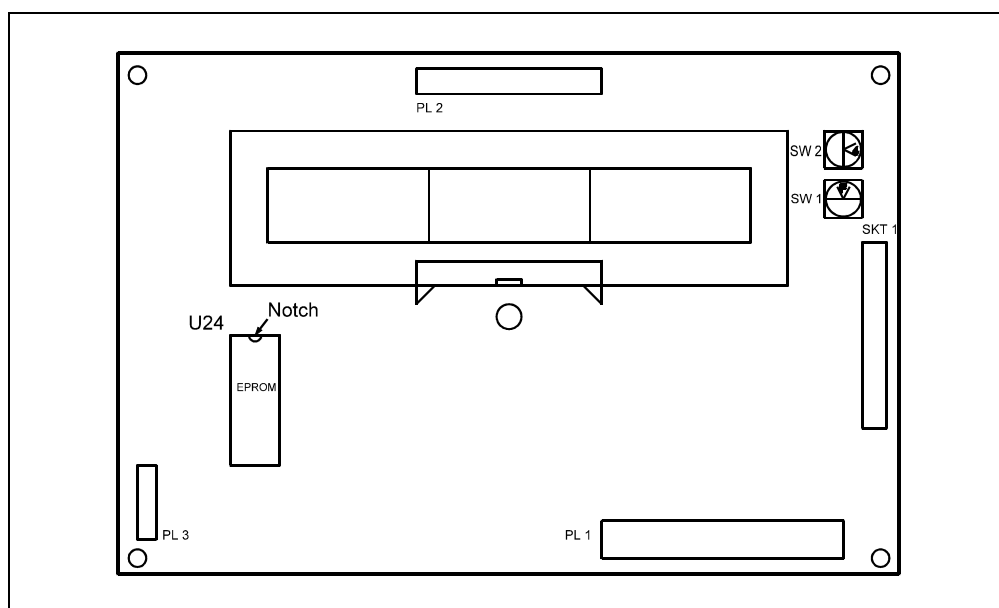
When this rolling display appears then the main Interface Unit program is running and alternative displays can be chosen using the black selector button on the right hand side of the unit. This button should be pressed twice in order to display the MODE value.

Please note that the symbol ~ may show on the displays whilst these checks are being made but this should be ignored.

The table below shows the configurations normally used with the ZED260 Guidance System:

Laser Type	Mode	switch settings	
		SW1	SW2
Normal tunnel laser	4	C-F	4
T1000 laser theodolite (6 button type)	1	0	1
T2000/2002 laser theodolite	1	1	1
T1000/1600 laser theodolite	1	2	1
Sokkisha Red Mini II EDM	1	3	1
T1010/1610 laser theodolite (metric units)	1	4	1
T1010/1610 laser theodolite (imperial units)	1	5	1
TM1100 (with motor control)	1	6	1
TM1100 (without motor control)	1	7	1
TCA1100/TPS1000 (with GUS64 Tracking)	1	8	1
TCA1100/TPS1000 (with GUS64 Standard)	1	9	1
TCA/TPS1100 (For IR Target)	1	A	1
TCRA/TPS1100	1	B	1

If the configuration is incorrect then it can be changed using two small rotary switches fitted inside the Interface Unit. In order to gain access to these switches, power should be disconnected from the unit and the lid removed by releasing the four retaining screws. The two small red switches (SW1, SW2) will be found on the right hand side of the circuit board (see below). When the required configuration has been selected the lid should be replaced before power is reconnected and the configuration re-checked as detailed above. A complete list of Interface Unit configurations is provided on the inside of the lid although it should be noted that the additional modes detailed are not for use with the standard ZED260 Guidance System.



Lid lable v5 :-

Switch positions for Interface Unit (Issue 5)

SW1 Selects the type of theodolite or E.D.M.

0	Leica T1000
1	Leica T2000/T2002
2	Leica T1000 (14 button version)
3	Sokkisha Red Mini II E.D.M
4	Leica T1010 - Metric
5	Leica T1010 - Imperial
6	Leica TM1100, TPS1000 series (with motor control)
7	Leica TM1100, TPS1000 series (without motor control)
8	TCA1100+GUS 64, TPS1000 series (Tracking Distance)
9	TCA1100,+GUS 64 TPS1000 series (Standard Distance)
A	Leica TCRA TPS 1100/1200 series for Infra-Red Target
B	Leica TCRA TPS 1100/1200 series - Metric
C	Leica TCRA TPS 1100/1200 series - Imperial
D	Leica TCA 1200 with GUS 74 - Metric
E & F	No Theodolite functions

Note that for older theodolites using SW 1 settings 0 to 5 then a suffix "B" program chip is required.

Remember to disconnect theodolite from IFU or select mode 4 (SW2) before using keyboard.

SW2 selects options for Auto/Manual Distance and Angles

0 or F	Take MA value from PC link, if available
1	MA1 = Auto Angles / Auto Distance
2	MA2 = Auto Angles / Manual Distance
3	MA3 = Manual Angles / Auto Distance
4	MA4 = Manual Angles / Manual Distance
5	MA5 = Auto Angles / Wheel Unit
6	MA6 = Manual Angles / Wheel Unit
7	MA7 = PipeJacking with Wheel Unit
8	MA8 = PipeJacking with Auto Distance (EDM)
9	MA9 = Pipejacking with ZED 260 PR
A .. D	not used. Take MA value from IBM
E	Reset count value to zero (for wheel unit) and force CNT valid. MA value = 7 & Stage = 1.

For Wild/Leica T1000/T2000/T2002 the following setting up is required before automatic operation is possible (for T1010 and TM1100 see separate setting up sheet) :

[SET] [MODE] 74 [RUN] 1 [RUN] - Sets T2000 format.

[SET] [MODE] 76 [RUN] 0 [RUN] - Selects GRE mode.

[SET] [MODE] 78 [RUN] [RUN] - Sets serial GSI standard (2400 Baud, 7 bits, even parity).

[SET] [MODE] 74 [RUN] 0 [RUN] - Sets T1000 format.

When the system is used with a standard tunnelling laser (Mode 4) then the select button on the Interface Unit can be used to show three different displays :-

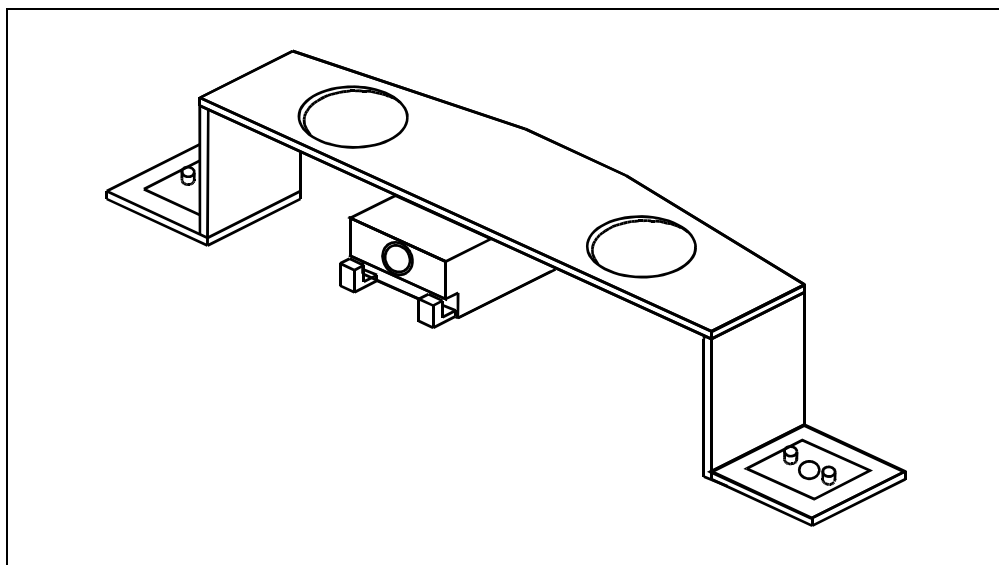
- a) The normal rolling display showing the Global laser Position (Northing, Easting, Level), laser Bearing (LB) and laser Elevation (LE). The global position is shown in metres and the angles are normally shown in gons. The angles will be shown in Degrees:Minutes:Seconds if a T1010 theodolite is used and it has been set to operate with degrees.
- b) The operating Mode of the Interface Unit.
- c) The Spot Position of the laser on the Target Unit (XS and YS in mm).

When the system is used with a Laser/Theodolite/EDM then a fourth display is available that shows the EDM distance (DD) in millimetres. This value is also displayed on the rolling display.

2.1. LASER THEODOLITE OPTIONS

When the ZED system is used with a Leica laser/theodolite/EDM the following factors should be noted :-

- a) The Interface Unit will provide power for the theodolite system although it will not recharge any batteries fitted in the theodolite. Because the Interface will normally control the theodolite it is not possible to set-up the theodolite whilst it is connected to the interface unless the interface is set to Mode 4 as described above. It is recommended that setting up of the theodolite is done using its internal batteries and disconnected from the ZED system.
- b) The laser eyepiece must be aligned with the optical centre of the theodolite telescope and the laser should be focused to give a 10-20mm diameter laser spot on the target screen (see Leica literature for details).
- c) Normally a Distomat Offset Bracket will be used with the laser/theodolite/EDM combination. (However a Mini prism array can be mounted on the Target Unit negating the need for a Distomat Offset Bracket). The EDM should first be mounted onto the theodolite and adjusted so that the axes of the two units are parallel (see details in Leica handbook). The EDM is then mounted onto the offset bracket and the counterweight fixed on the opposite side. When the offset bracket assembly is mounted onto the theodolite it is also adjusted to again align the EDM to be parallel to the theodolite telescope (the adjustment screws are identical to those on the EDM and will be found above the telescope eyepiece).



d) The cable made by ZED Tunnel Guidance to connect the theodolite to the Interface Unit, is interchangeable with the Leica cable used to connect a theodolite to a GRE data recorder. If a DL2/DL3 laser is used then the Intensity Regulator of the DL2/DL3 is connected to the Interface Unit via the ZED cable and to the Theodolite via the cable supplied with the DL2/DL3.

e) The data format used by the Interface Unit to theodolite link is the standard Leica serial format :

2400 Baud

1 start bit

7 data bits

1 stop bit

even parity

This mode of operation should be set on the theodolite before connecting to the ZED system. A typical theodolite key sequence to do this would be :

SET MODE 78 RUN RUN

f) The theodolite must be set to record data to a GRE device rather than a REC module. This should be done before the unit is connected to the ZED system. A typical theodolite key sequence to do this would be :

SET MODE 76 RUN 0 RUN

The theodolite must be set to record data in the standard record format of:-

Point No.
Hz circle
V circle
Slope Distance
ppm mm

A typical theodolite key sequence to do this would be :

SET REC • RUN REC

- h) The Leica T1000 (14 button keypad version) can support T1000 and T2000 communications protocols. It is recommended that the T1000 protocol is used with the ZED system and the corresponding settings made in the Interface Unit. If the T2000 protocol is used then the Interface Unit should be set for T2000 operation.
- i) If a Leica T1010 theodolite is used then the following menu operations are required:-

MENU 3 3 (selects REC, PORT)
- then select RS232 using the arrow keys followed by CONT.

MENU 4 3 1 (selects CONF, COMM, STANDARD)
- followed by CONT.

MENU 3 1 (selects REC, SELECT)
- then select MASK >1 using the arrow keys
- followed by CONT.

MENU 3 2 1 (selects DEFINE, REC MASK 1)
- then use the arrow keys to select WI 1 to WI 8 and set

WI 1 > PtNr
WI 2 > Hz
WI 3 > V
WI 4 > ∠
WI 5 > ----
WI 6 > ----
WI 7 > ----
WI 8 > ----

- followed by CONT.

When the T1010 theodolite is set to read in degrees then the display on the Interface Unit will show the laser angles in Degrees:Minutes:Seconds. When it is set to Gons or Mil then the Interface Unit will show the angles in Gons.

- j) If a Leica TM1100 or TCA1100 theodolite is used then the following menu operations are required:-

Note: After the theodolite set up procedure is completed switch off the theodolite before connecting it to the Interface Unit in on-line mode

Select Autoexecute program and Main Menu:

Press **CONF** (F3)
Using ↑ ↓ keys select **Define functionality**
Press ↵ key to accept setting
If the function **Show all menus & keys** is not enabled (is followed by **:NO**)
Select **YES (F6)**
Press **CONT** to return to Main Menu
Press **CONF** (F3)
Using ↑ ↓ keys select **Autoexec**
Press ↵ key to accept setting
Press **LIST** (F6)
Using ↑ ↓ keys select **Main Menu**
Press ↵ key to accept setting
Press **CONT** to return to Main Menu

Select Communication parameters:

Press **CONF** (F3)
Using ↑ ↓ keys select **GeoCom**
Press ↵ key to accept setting
Press **DFLT** (F5)
Press **CONT** to return to Main Menu

Select EDM parameters:

Press **CONF** (F3)
Using ↑ ↓ keys select **EDM selection**
Press ↵ key to accept setting
Press **LIST** (F6)
Using ↑ ↓ keys select EDM type in use
Press ↵ key to accept setting
Press **CONT** to return to Main Menu

Set Azimuth zero:

Press **MEAS** (F6)
Press **H_z-0** (F5)
Type in new value or edit using **EDIT** (F6)
Press ↵ key to accept setting
Press **CONT**
Press **ESC** to return to Main Menu

With the TM1100 it is possible to input the global position of the laser into the ZED system from the theodolite as well as from the portable terminal and PC. To do this, from Main Menu:

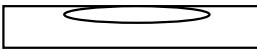
Press **SETUP** (F5)
Press **LIST** (F6)
Using ↑ ↓ keys select **USER 1** or **Standard**
Press ↵ key to accept setting

Press **CONT**
Using $\uparrow \downarrow$ keys select **Northing, Easting and Level** in turn and type in new values or edit existing values using **Edit (F6)**
Press $\downarrow$ key to accept each setting
Press **CONT** to return to Main Menu

Make sure EDM ppm value is set to zero:- to do this connect the interface-theodolite cable directly to the EDM and carry out the following:

Press **ON**
Hold ppm button for about 5 seconds
To alter displayed value press ppm button
Press **OFF**

To fine adjust level:

Press .....key
Using tribach center bubble on electronic display
Press **CONT** to return to Main Menu

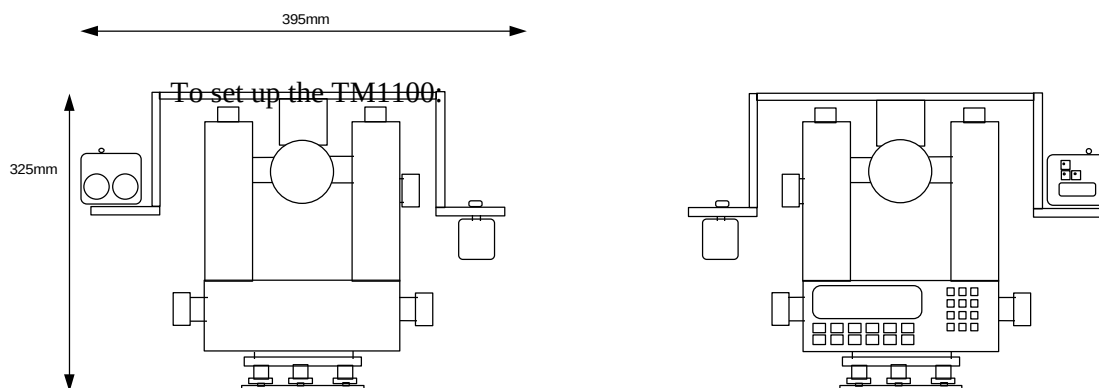
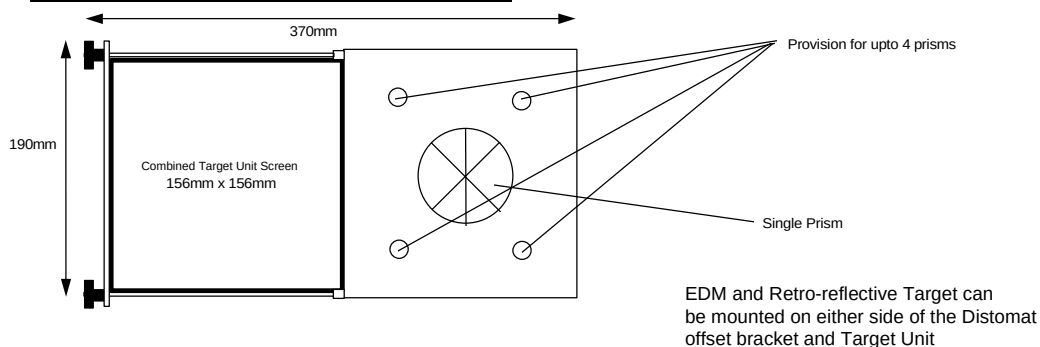
- k)** If a Leica TCA/TPS1100 or TCRA/TPS1100 theodolite is used then the set-up is mostly under software control. The only item that requires the user set-up is the GeoCom communications mode, the following menu operations are required:-

From the MAIN MENU
select item 5 Configuration
select item 2 Communication Mode
select item 2 GeoCom Parameters
set the Baudrate to 9600

Note: After the theodolite set up procedure is completed switch off the theodolite before connecting it to the Interface Unit in on-line mode

2.1.1. MOTORISING THE LASER THEODOLITE

ZED Tunnel Guidance is able to supply a motorisation kit that enables a Leica laser theodolite to be automated and controlled so that the laser spot follows the Target Unit as the tunnel progresses. Full instructions are provided with the motorisation kit to enable the user to operate and adjust this assembly. The ZED motorisation software will also drive the Leica TM1100 and Newer motorised theodolites / Total Stations.

TM1100 with ZED Distomat offset bracket**ZED Combined Target Unit with Retro - Reflective Target**

- 1) Mount theodolite on tripod.
- 2) Level using tribrach and centering bubble.
- 3) Remove telescope lens cap.
- 4) Remove eye piece by turning locking ring anti-clockwise.
- 5) Mount laser eye piece with locating screw on left hand side and turn locking ring clockwise.
- 6) Connect laser to regulator with cable supplied.
- 7) Connect interface to regulator "12v IN" socket and regulator "12v OUT" socket to theodolite using two interface-theodolite cables.
- 8) Remove theodolite carrying handle and plastic cover to expose gold plated hot shoe contacts and mount offset bracket.
- 9) Mount DI1001 EDM on offset bracket and counter weight on opposite side. The EDM counter balance which screws to the underside of the EDM is **not** to be fitted.
- 10) Connect EDM to theodolite with offset cable using socket on offset bracket.

Note: Powering-on the interface with the side button depressed allows the theodolite to be used manually.

2.1.2. RADIO INTERFACE UNIT OPTIONS

The Radio Interface Unit provides an RF link to the rest of the ZED Guidance system. No setup is required but it must be used with its paired Radio Modem Unit. Its RF antennae should be mounted near to the Total Station and in a Vertical position using the supplied RF cable.

No other setup is normally required.