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SOLO*net*

Digital Infrared Thermometer

User Guide

LAND SOLOnet

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The Quality Management System of Land Instruments International Limited is approved to **BS EN ISO9001:2000** for the design and manufacture, stockholding, in-house repair and site servicing of non contact temperature measuring instrumentation.

Associated software designed and developed in accordance with **TickIT**.

Calibration certificates are available from our **UKAS** accredited Calibration Laboratory No. 0034. The Land calibration laboratory complies with the requirements of the international standard **BS EN ISO/IEC 17025**.

CE This product complies with current European directives relating to electromagnetic compatibility and safety (**EMC directive 89/336/EEC; Low voltage directive 73/23/EEC**).

All packaging material used for this product can be recycled.

SAFETY INFORMATION

| SYMBOL	PUBLICATION	DESCRIPTION
$\overline{}\overline{}\overline{}$	IEC 417, No.5031	Direct Current
$\sim$	IEC 417, No.5032	Alternating Current
$\overline{\sim}$	IEC 417, No.5033	Both direct and alternating current
$3\sim$	IEC 617-2, No.02-02-06	Three-phase alternating Current
⏚	IEC 417, No.5017	Earth (ground) terminal
⏚ (circled)	IEC 417, No.5019	Protective conductor terminal
⏛	IEC 417, No.5020	Frame or chassis terminal
⏚ (triangle)	IEC 417, No.5021	Equipotentiality
│	IEC 417, No.5007	On (supply)
◯	IEC 417, No.5008	Off (supply)
▢	IEC 417, No.5172	Equipment protected throughout by double insulation or reinforced insulation (equivalent to Class II of IEC 536)

SAFETY INFORMATION (Continued)

SYMBOL	PUBLICATION	DESCRIPTION
	ISO 3864, No. B.3.6	**WARNING** Risk of electric shock
	ISO 3864, No. B.3.1	**Caution**
	BS EN 100015	Observe precautions for handling electrostatic discharge sensitive devices
	BS EN 60825-1	**WARNING** Laser Radiation
		Refer to the operating instructions
		Note
	WEEE Directive 2003/108/EC	Do not dispose of this product together with your household waste. Please refer to the information of your local community or contact our Distributors regarding the proper handling of end-of-life electric and electronic equipment. Recycling of this product will help to conserve natural resources and prevent potential negative consequences for the environment and human health caused by inappropriate waste handling.

TECHNICAL SUPPORT

Technical support for the LAND *SOLOnet* Digital Infrared Thermometer can be obtained by either contacting the address / telephone number on the cover of this User Guide or by e-mail at the following address:

solonet.support@landinst.com

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PRODUCT WARRANTY

Thank you for purchasing your new product from Land Instruments International. This Land manufacturer's 'back-to-base' warranty covers product malfunctions arising from defects in design or manufacture. The warranty period commences on the instrument despatch date from the Land Instruments International Ltd. factory in Dronfield, UK

<u>24 MONTHS WARRANTY</u>

Building upon the reputation for reliability and longevity that our thermometers have earned, Land are delighted to be able to provide our customers with an industry-leading 24 month warranty for the following products:-

•   SOLOnet thermometers
•   SOLOnet mountings and accessories
•   SOLOnet Interface units and software

This 24 month warranty is provided as standard for all orders for the products listed above received from 1st April 2005. We believe that our customers expect us to set the standard in terms of performance, quality, reliability and value for money. This 24 months warranty, as a part of an on-going program of continuous improvement, is just one way in which Land strive to maintain our position as the temperature measurement partner of choice.

<u>EXCLUSIONS FROM WARRANTY</u>

It should be noted that costs associated with calibration checks which may be requested during the warranty period are not covered within the warranty. Land reserve the right to charge for service/calibration checks undertaken during the warranty period if the cause is deemed to fall outside the terms of the warranty. This Land manufacturer's warranty does not cover product malfunction arising from:-

•   incorrect electrical wiring.
•   connection to electrical power sources outside the rating of the product.
•   physical shock (being dropped, etc.) and impact damage.
•   environmental conditions exceeding the IP/NEMA rating of the product.
•   environmental conditions outside the ambient temperature, humidity and vibration rating of the product.
•   environmental contamination (solvent vapours, deposition of airborne contamination, cooling liquids of non-neutral pH, etc.).
•   overheating as a result of interruption of water/air flow through cooling jackets or of incorrect installation.
•   inappropriate modification (drilling holes in thermometer bodies, etc.).
•   inappropriate recalibration resulting in calibration outside specification.
•   attempted repair by a non-Land-authorised repair centre.

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1.0   INTRODUCTION

1.1   General Introduction

This publication provides the necessary information required to safely operate the Land *SOLOnet* digital thermometer. This manual should be used in conjunction with the other publications of the Land *SOLOnet* series (Thermometer Quick-Start Guide - PP305 / Thermometer Installation Guide - PP308 / Mountings and Accessories Installation Guide - PP310).

It is important to fully check all equipment with which you have been supplied.

The equipment must only be used, maintained and serviced by suitably trained personnel, capable of carefully following the procedures and guidelines given in this User Guide and associated literature.

All Land *SOLOnet* literature should be read thoroughly before proceeding with any operations detailed within it. It is also advisable that all supplied literature is kept readily available, for reference when the equipment is in general use.

1.2   About *SOLOnet* Digital Thermometers

Land *SOLOnet* is a compact, web browser enabled infrared thermometer system offering the user maximum flexibility and connectivity. There are several different thermometer types with choice of operating wavelength, optical variants, laser alignment and measurement ranges to suit applications within the operating range of 200 to 1750°C/392 to 3182°F.

307001

Fig. 1 - Land *SOLOnet* Digital Thermometer

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1.3   Nomenclature

The Instrument detail label is positioned at the top of the rear face of the *SOLOnet* casing, adjacent to the 'Power/Comms' LED. The instrument 'Type' specifies the thermometer variant and variant options. The instrument 'Serial Number' is a unique number incorporating the manufacture date code (see Fig. 2)

Upon receipt of the instrument, check and make a note of the Instrument 'Type' and 'Serial Number' in the spaces provided below.

Instrument Type:

Serial Number:

SN11 - (550 to 1750°C/1022 to 3182°F, 100:1 optics, 1µm wavelength)

SN21 - (250 to 1300°C/482 to 2372°F, 100:1 optics, 1.6µm wavelength)

SN51 - (200 to 1100°C/392 to 2012°F, 50:1 optics, 5µm wavelength)

SNR1 - (700 to 1750°C/1292 to 3182°F, 100:1 optics, 1µm ratio wavelength)

Y - (Laser Alignment Option)

123456 - (Unique Instrument Serial Number)   **01** - (Date Code)
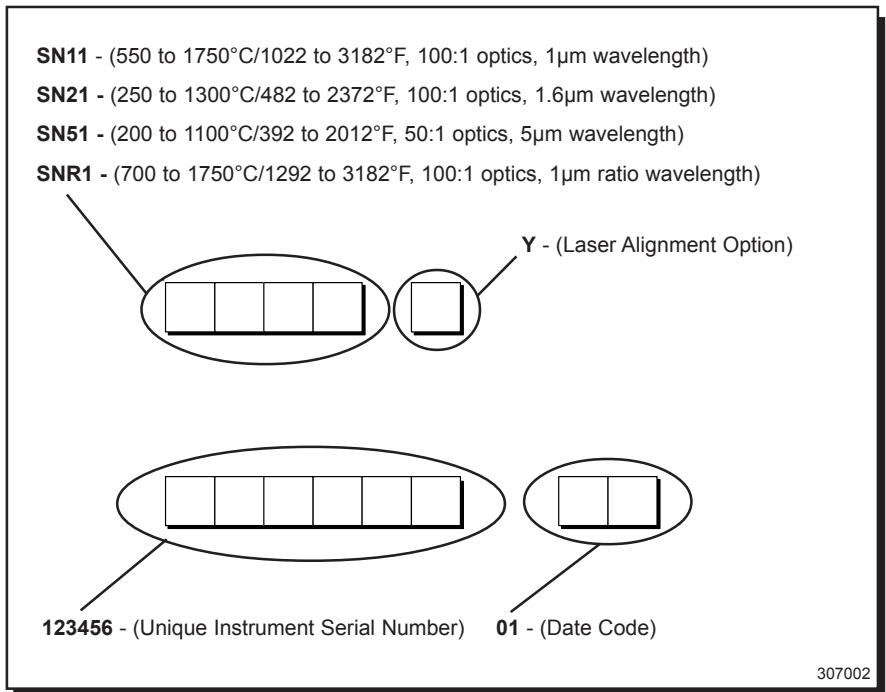
307002

Fig. 2 - Land *SOLOnet* Digital Thermometer Nomenclature

2.0　SPECIFICATIONS

2.1　SOLOnet Thermometers

Model..	SN11	SN21	SN51	SNR1
Operating range:	550 to 1750°C/ 1022 to 3182°F	250 to 1300°C/ 482 to 2372°F	200 to 1100°C/ 392 to 2012°F	700 to 1750°C/ 1292 to 3182°F
Specified range:	600 to 1750°C/ 1112 to 3182°F	300 to 1300°C/ 572 to 2372°F	250 to 1100°C/ 482 to 2012°F	750 to 1750°C/ 1382 to 3182°F
Spectral response:	1µm	1.6µm	5µm	1µm ratio
Field of view (95% energy):	100:1	100:1	50:1	100:1
Focusing:	Fixed, user configurable focus:　250mm/9.8in, 500mm/19.7in, 1000mm/39.4in and infinity			
Output:	0 or 4 to 20mA user selectable (isolated 50V)			
Response time (0 to 90%):	10ms	10ms	50ms	10ms
Emissivity:	0.10 to 1.00			
Non greyness:	0.80 to 1.25			–
Resolution (mid range):	<1K			
Stability:	0.2°/°	0.2°/°	0.02%K/K	0.05K/K
Accuracy (absolute):	0.3%K	2K	0.35%K	0.6%K
Time functions:	Peak picker, track and hold, and averager			
Alarm outputs:	Process high, process low, internal temperature, emissivity/NG signal lost, insufficient signal (SNR1 only); rated to 50V d.c., 0.1A non-inductive, NO or NC – software selectable			
Optional sighting:	Laser defining optical axis; class 2, 1mW, 650nm, 120s ON duration, automatic switch-off			
Ambient limits:	5 to 60°C/41 to 140°F specified; 0 to 70°C/32 to 158°F operating			
EMC:	EN 61326:1999 (immunity and emission)			
Sealing:	IP65/NEMA 4X			
Vibration:	3g (10 to 300Hz)			
Power supply:	18 to 30V d.c. (24V d.c. nominal)			
Optional accessories:	Air cooled/purged jacket, water cooled/air purged jacket, air purge and mounting bracket, 1-axis and 2-axis adjustable mounting brackets, 3m, 15m, 25m prewired cable assemblies, Web/Ethernet Interface Unit SN-W/E, d.c. power supply unit, temperature indicator unit LMi			

2.2   SN-W/E Interface Unit

Specifications

Mounting:	DIN Rail
Power Requirements:	24V d.c. nominal
Ambient Operating range:	0 to 70°C/32 to 158°F
Sealing:	To IP20/NEMA1
EMC:	EN 61326:1999

Wiring Details (Customer and Thermometer connections)

Pin No.	Function
1	Power In (+)
2	Power In (-)
3	mA Out (+)
4	mA Out (-)
5	Emissivity In (+)
6	Emissivity In (-)
7	Laser Switch Input
8	Common (laser and command)
9	Command Switch Input
10	Relay 1a
11	Relay 1b
12	Relay 2a
13	Relay 2b
14	Comms from IRT (+) [Y]
15	Comms from IRT (-) [Z]
16	Comms to IRT (-) [B]
17	Comms to IRT (+) [A]

3.0   HARDWARE CONFIGURATION REQUIREMENTS

This section of the User Guide contains additional information to that found in the *SOLOnet* Installation Guide (PP308), therefore it is recommended that the two publications be cross-referenced when installation of the system is implemented. Associated User, Assembly and Installation Guides provided with any system accessories should also be refered to.

The following diagrams are only intended to give a range of examples illustrating the flexibility of *SOLOnet* connectivity. Should the intended application differ from those illustrated, please contact Land Instruments for information on how *SOLOnet* can be configured to suit the specific requirement.

3.1   General Introduction

At the heart of a Land *SOLOnet* thermometer is a powerful digital core, capable of handling internal signal conversions, controlling and monitoring I/O and performing various temperature time functions. Built around this core are high quality optical and mechanical parts, accessories and robust interface electronics, which ensure trouble-free installation and reliable operation.

3.2   Introduction to Configuration

Most users may want to configure the thermometer to suit their own particular requirements. Land *SOLOnet* thermometers provide various options for instrument configuration. This section briefly describes the schemes available, together with the minimum hardware requirements for 'off-line' configuration. Any of these schemes may also be incorporated into full installations for 'on-line' configuration.
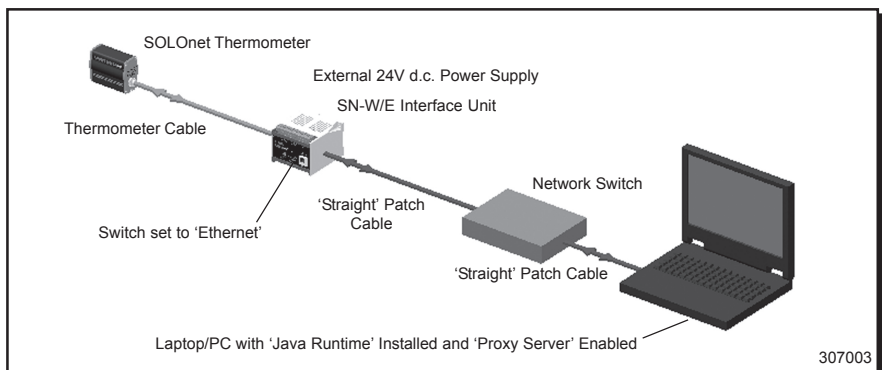
3.2.1 Web Browser Configuration - Via Network

Fig. 3 - *SOLOnet* Thermometer in Web Browser Configuration - Via Network

The SN-W/E Interface Unit manages and converts the RS485 messaging from the thermometer, allowing the user to configure the thermometer using standard web browser software. Additionally, the user may modify the SN-W/E IP address to integrate it within an organisational network.

The SN-W/E is supplied with: the **'IP Address'** set to **10.1.10.200**
     the **'Subnet Mask'** set to **255.255.0.0**

It may be connected directly to a company network, providing this IP address is not already in use. Alternatively, it may be connected to an Ethernet switch as shown in Fig. 3. Using this method, the IP address may be changed or set to be dynamically assigned if the intended network requires this.

> ℹ️ **Note**
>
> If the company network operates a 'MAC address' filtering system, the MAC address must first be added to the network configuration.
>
> Contact local network manager for details.

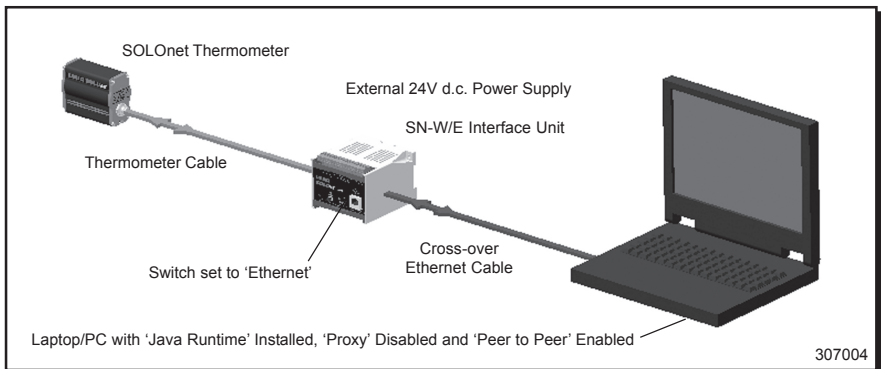## 3.2.2 Web Browser Configuration - Via Direct Connection

Fig. 4 - *SOLOnet* Thermometer in Web Browser Configuration
- Via Direct Connection

This scheme ('Peer to Peer') may be used where a network is not available. A cross-over Ethernet cable will be required and the PC/laptop will need to be configured for 'Peer to Peer' operation, as described in Appendix A and B.

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3.2.5 Windows XP Hyperterminal - Direct 4-Wire RS485

SOLOnet Thermometer

External 24V d.c. Power Supply

Thermometer Cable

RS232 to RS485
Converter

RS232 Serial Cable

Laptop/PC Running 'Windows XP' O.S. with 'Hyperterminal' Open

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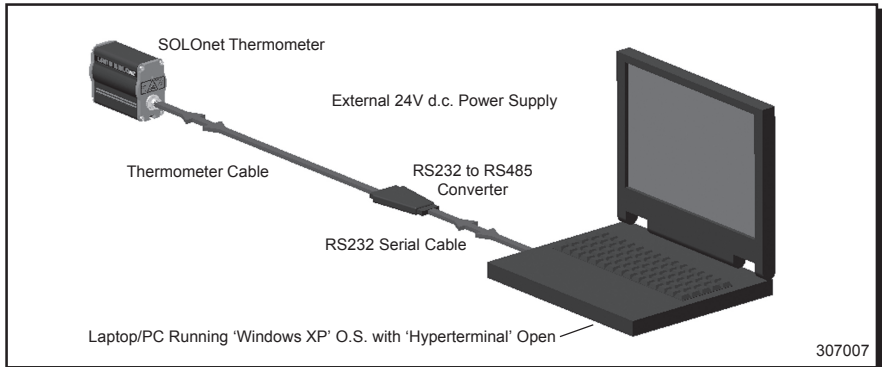
Fig. 7 - *SOLOnet* Thermometer Configuration Via Windows XP Hyperterminal

This scheme is for <u>advanced users only</u> and allows the user to connect a laptop or PC by RS485, to configure a *SOLOnet* thermometer. An RS232 to 4-wire RS485 converter is required and the laptop/PC requires Windows 98/2000/XP operating system, with the 'Hyperterminal' utility opened. An external 24V d.c. power supply is required to power the thermometer and this is wired direct through the thermometer cable.

With this method of configuration, only addresses 1 to 127 are accessible. The addresses above 127 are available, but the relevant characters are hidden and require the use of a utilities programme (such as 'Procomm Plus') to allow them to become visible and therefore useable.

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4.0 INSTRUMENT SETUP AND CONFIGURATION

4.1 Web Browser Configuration

These instructions detail how to setup and configure a ***SOLOnet*** thermometer from a laptop or PC, via the built-in webserver. 'Java Runtime' must be pre-installed (see Appendix A) and any 'Pop-up' blockers must be disabled. Typically, 'Pop-up' blockers can be found in 'Internet Properties' under 'Privacy'.

4.1.1 'Home' Page Access

- Open a session of Internet Explorer (or equivalent web browser).
- Enter the IP address into the address bar, eg. 'http://10.1.10.200'.
- When the ***SOLOnet*** index page opens, click '***SOLOnet*** PC' (If the '***SOLOnet*** PC' screen is not in view, click the maximise screen button).
- The 'Home' page for that particular instrument opens (see Fig. 8).

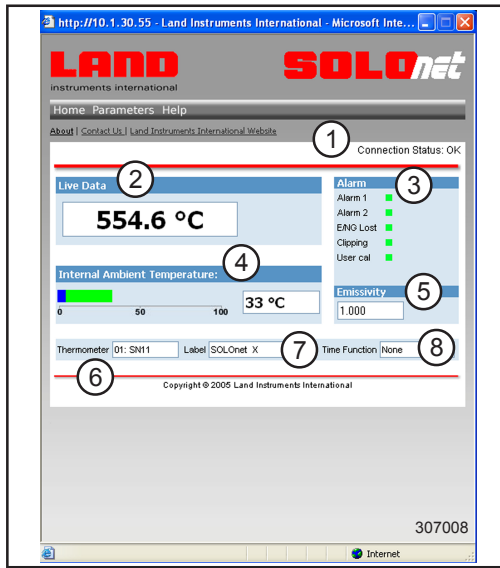
Fig. 8 - ***SOLOnet*** web interface 'Home' page

Item	Description	Function
1	Connection Status	'OK' - Successful connection 'Lost' - Unsuccessful connection
2	Live Data ᴧ ᴧ ᴧ ᴧ ᴠ ᴠ ᴠ ᴠ	Dynamic temperature reading from thermometer Over range temperature reading Under range temperature reading

Item	Description	Function	
3	Alarm	'Alarm 1'-	green LED (alarm 1 state: passive) red LED (alarm 1 state: active)
		'Alarm 2'-	green LED (alarm 2 state: passive) red LED (alarm 2 state: active)
		'E/NG Lost' - emissivity/non-greyness external communications not found	
		Clipping - Indicates that the temperature indication may be in error. This can occur when the 'Averager' time function is applied to a process, where the temperature is fluctuating outside the measurement range of the instrument	
		'Obscured' - (SNR only, hidden on other variants) This indicates when radiant energy reaching the thermometer has fallen too low to provide reliable temperature indication e.g. sight path obscured by excessive levels of contamination or the hot object only fills a small area of the instrument F.O.V. target spot	
4	Internal Ambient	Internal ambient temperature scale and actual value displayed. Temperature: 0-5C/32-41F (bar displayed in blue) - low ambient temperature, outside specification; 6-60C/43-140F (bar displayed in green) - normal ambient temperature, within specification; 61-70C/142-158F - high ambient temperature performance to specification not guaranteed; 70C/158F+ (bar displayed in red) - above safe ambient temperature, performance to specification not guaranteed, probable damage to instrument (actual value displayed in red and highlighted)	
5	Emissivity/Non-greyness	Set by user, default set to 1 (IRT dependant)	
6	Thermometer	Instrument type as read from thermometer	
7	Label	Instrument I.D. read from instrument or allocated by user as required. May be modified by user	
8	Time Function	Selected time function - 'None', 'Averager', 'Peak Picker' or 'Track and Hold'	

4.1.2 'User Thermometer Settings' Page Access

- Mouse-over 'Parameters' to reveal the 'User Thermometer Settings' option.
- Click to reveal the 'Sign In' screen (see Fig. 9).
- Enter *SOLONET* in the 'User Name' box. ①
- Enter *SOLONET* in the 'Password' box. ②
- Press 'Continue'. ③
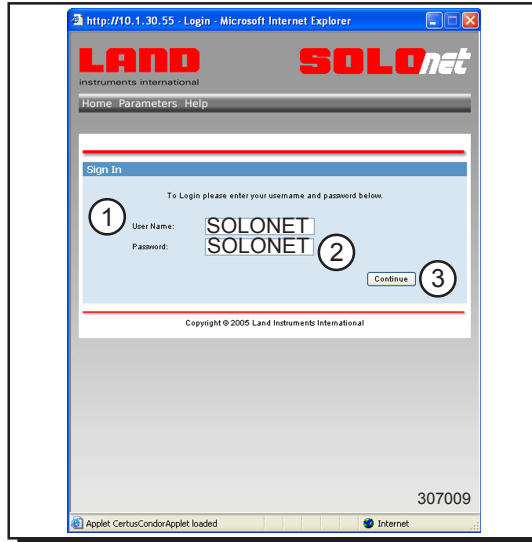- The 'User Thermometer Settings' screen appears (see Fig. 10).

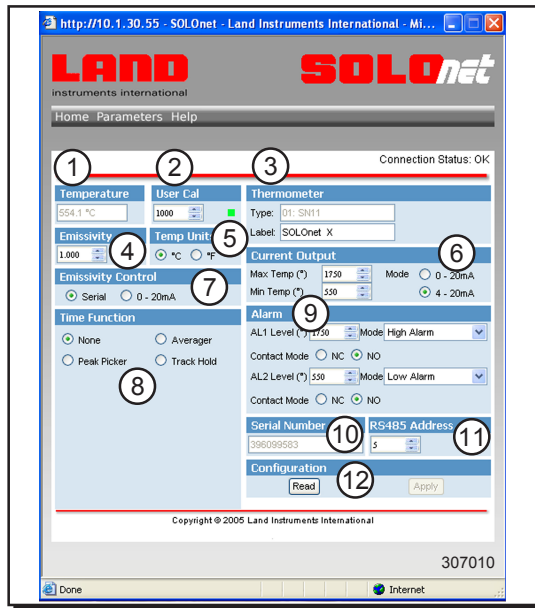Fig. 9 - *SOLOnet* web interface 'Sign In' screen (User Thermometer Settings).

Fig. 10 - *SOLOnet* web interface 'User Thermometer Settings' screen

Item	Description	User Settable	Function
1	Temperature	No	Dynamic temperature display
2	User Cal	Yes	For advanced users wishing to make a single-point adjustment to match the thermometer reading with a local temperature reference measurement WARNING - Changing this figure from the default (1000), temporarily changes the calibration of the instrument's temperature output, indicated by red LED
3	Thermometer	No Yes	'Type' - Instrument type as read from instrument 'Label' - Instrument I.D. read from instrument (alpha-numeric, 12 characters)
4	Emissivity or Non-greyness	Yes Yes	Set by user in the range 0.100 to 1.000 (default 1.000) Set by user in the range 0.800 to 1.250 (default 1.000)
5	Temp Units	Yes	Temperature display option - °C or °F
6	Current Output	Yes	'Max Temp' / 'Min Temp' - User defined temperature span (set within the thermometer temperature range minimum selectable span 50°C/90°F) 'Mode' - User defined, 0 to 20mA or 4 to 20mA
7	Emissivity Control	Yes	'Serial' -Set emissivity via serial port or web interface '0-20mA' - Set via external linear current signal. E: 2mA=0.100; 20mA=1.000 NG: 2mA=0.800; 20mA=1.250
8	Time Function (see Chapter 6.0)	Yes	'None' - No time function selected. 'Averager' - Adjustable response speed permitting smoothing of the temperature output signal in relation to the temperature input ('Time Constant' - 0 to 512s). 'Peak Picker' - Allows the user to monitor the highest temperature values in a rapidly varying process ('Mode' - Reset or Hold/'Threshold' - Tmin° to Tmax°/ 'Decay Rate' - 0 to 512°/s/'On Delay' - 0 to 10s in 0.1s increments/'Off Delay' - 0 to 10s in 0.1s increments). 'Track and Hold' - Tracks a peak temperature value and holds it until the next high temperature is detected
9	Alarm	Yes	'AL1 Level (°)' - Set alarm 1 temperature level 'Mode'. Low Alarm (indicates when the process temperature falls below the set specified limit). High Alarm (alarm level set to high range value). Ambient Alarm (indicates when the internal thermometer temperature exceeds the safe internal ambient limit). E/NG Lost Alarm (alarm set to indicate loss of emissivity/Non Greyness signal. Obscuration Alarm (alarm level set to indicate excessive obscuration (Ratio thermometers only))

Item	Description	User Settable	Function
			'Contact Mode' - NC/NO (Normally Closed / Open) 'AL2 Level (°)' - Set alarm 2 temperature level 'Mode' - Low Alarm / High Alarm / Ambient Alarm / E/NG Lost Alarm / Obscuration Alarm 'Contact Mode' - NC (Normally Closed) / NO normally Open) **NOTE:** For 'failsafe' operation use 'NC' option
10	Serial Number	No	Displayed as read from instrument
11	RS485 Address	Yes	User setable RS485 address (1-254)
12	Configuration	Yes	'Read' - Refreshes the values displayed 'Apply' - Transfers the set values to the thermometer and saves the set values to non-volatile memory of the thermometer (greyed-out if no changes have been made)

4.1.3 'Off-line Commissioning (Restricted)' Page Access

- Mouse-over 'Parameters' to reveal the 'Off-line Commissioning (Restricted)' option. This screen allows restricted access, via a further password screen, to commissioning options. During access to this screen, thermometer setup is carried out off-line.
- Click to reveal the 'Sign In' screen (see Fig. 11).
- Enter *Land* in the 'User Name' box. ①
- Enter *offline* in the 'Password' box. ②
- Press 'Continue'. ③
- The 'Off-line Commissioning (Restricted)' screen appears (see Fig. 12).

⚠ **Caution**

Once the 'Continue' button has been clicked to enter the 'Off-line Commissioning (Restricted)' screen, the ability of the thermometer to make dynamic, on-line temperature measurements is disabled.

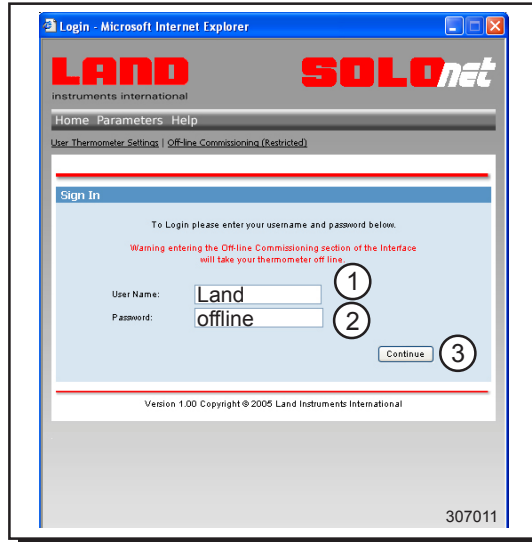Dynamic on-line temperature measurement resumes when this screen is closed.

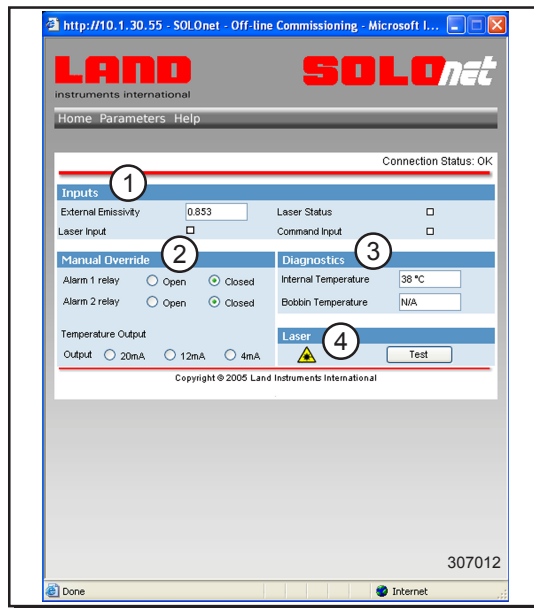Fig. 11 - *SOLOnet* web interface 'Sign In' screen (Off-line Commissioning).

Fig. 12 - *SOLOnet* web interface 'Off-line Commissioning (Restricted)' screen

Item	Description	Function
1	Inputs	'External Emissivity' or 'External Non-greyness' setting - set by user via external 0 to 20mA current (valid range 2 to 20mA - display 0.05 when no signal applied). 'Laser Status' - White LED (laser passive), Red LED (laser active). 'Command Input' - White LED (command input passive), Red LED (command input active). 'Laser Input' - White LED (laser contacts open), Red LED (laser contacts closed)
2	Manual Override	'Alarm Relay 1' 'Open' / 'Closed' - User selectable to allow relay 1 state to be changed and tested externally 'Alarm Relay 2' - 'Open' / 'Closed' - User selectable to allow relay 2 state to be changed and tested externally 'Temperature Output' '20mA' / '12mA' / '4mA' - User selectable output drive current
3	Diagnostics	'Internal Temperature' - Dynamic internal temperature of thermometer 'Bobbin Temperature' - Dynamic bobbin temperature (ratio thermometers only)
4	Laser	'Test' - Laser activation test (linked to laser switch input LED)

4.1.4 'Help' Options Access

Mouse-over 'Help' to reveal the help options.

Item	Description	Function
1	About	Link to information on thermometer software version
2	Contact Us	Link to 'Contact Us' page on www.landinst.com (internet access required)
3	Land Instruments International Website	Links to the 'Home' page of www.landinst.com (Internet access required)

4.2

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5.0   EXAMPLE INSTALLATION SCHEMES

A key design feature of the *SOLOnet* system is the flexibility of data access and the ease of instrument installation.

Although there are many schemes to match many applications, these schemes can be roughly catagorised into two main groups:

- •   Non-Ethernet - providing current and contact-closure I/O and 4-wire RS485 connectivity

- •   Ethernet (requires optional SN-W/E interface unit) - providing current and contact-closure I/O and Ethernet connectivity.

5.1 Typical Current and Contact-closure (Non-Ethernet) Installation

In it's simplest form, **SOLOnet** consists of a thermometer and cable, providing the user with process control and monitoring via traditional current and contact-closure I/O.
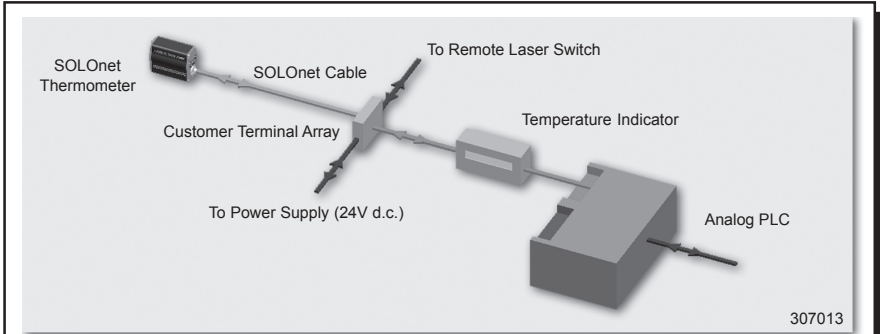

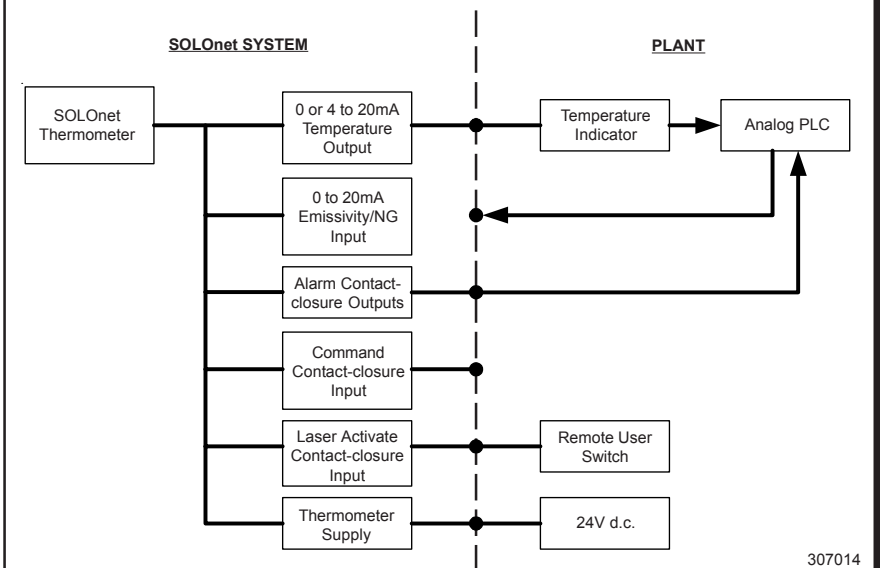Fig. 13 - Typical Current and Contact-closure (Non-Ethernet) Installation

Fig. 14 - Schematic Diagram for a Typical Current and Contact-closure (Non-Ethernet) Installation

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5.2 Typical RS485 (Non-Ethernet) Installation
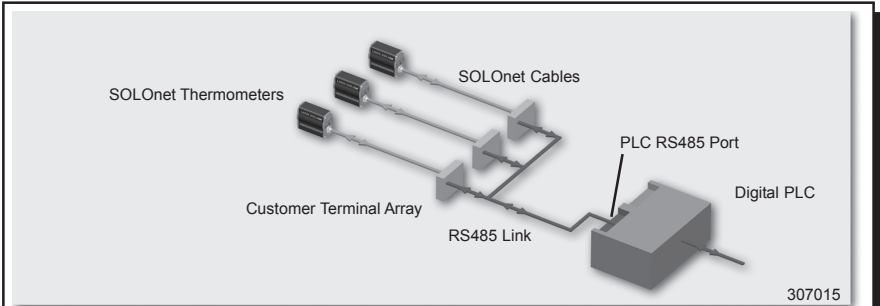

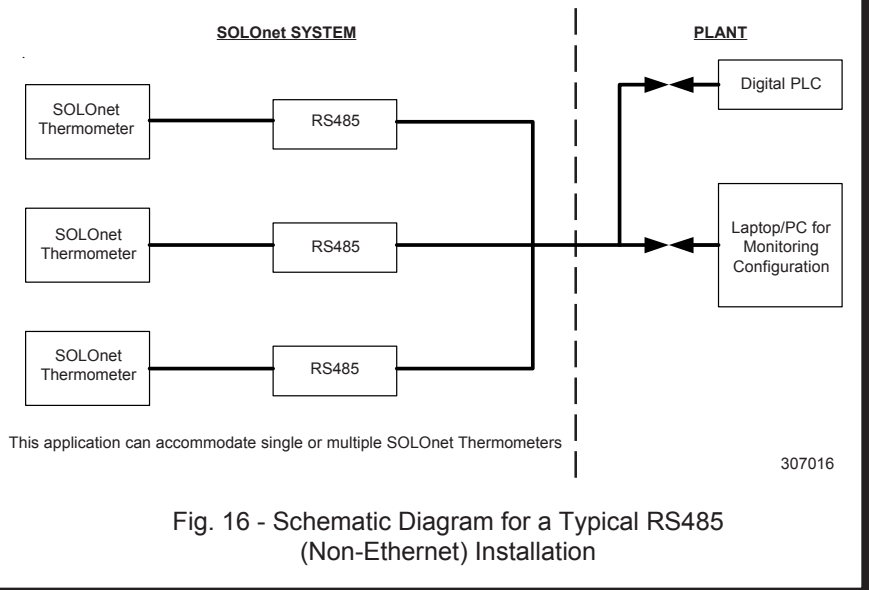Fig. 15 - Typical RS485 (Non-Ethernet) Installation

Fig. 16 - Schematic Diagram for a Typical RS485
(Non-Ethernet) Installation

The Current and Contact-closure I/O and RS485 schemes may be combined and used simultaneously if required.
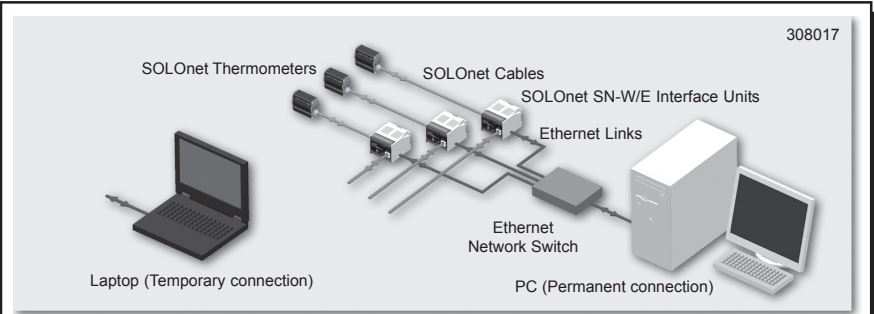
5.3   Typical Ethernet Installation
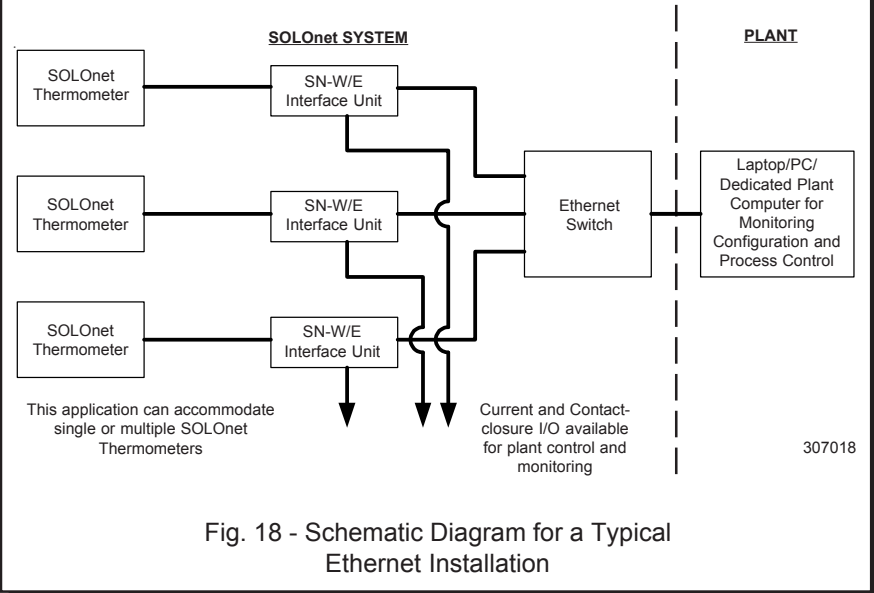

Fig. 17 - Typical Ethernet Installation

Fig. 18 - Schematic Diagram for a Typical
Ethernet Installation

LAND SOLOnet

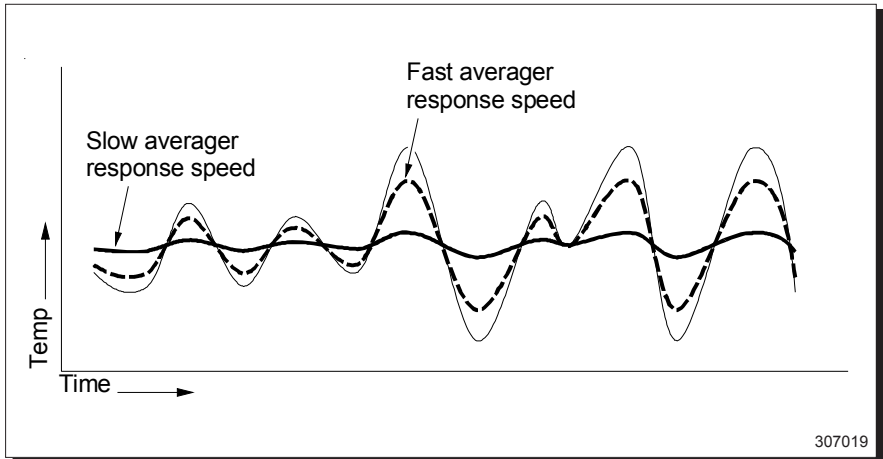### 6.0   TIME FUNCTIONS

6.1   Averager

Fig. 19 - Graphical Representation of the Averager Time Function

The Averager time function can be used to 'smooth' the temperature output signal in relation to the temperature input. The averager response can be adjusted to suit the application. With a fast response speed, the temperature output signal tracks the input signal closely, any rapid fluctuations in the input are reflected in the output. With a slow response speed, the temperature output signal is much smoother, displaying more the 'trend' of the input signal rather than rapid changes.

6.2   Peak Picker

The Peak Picker function can be used to monitor the highest temperature measured by the thermometer. This feature is useful especially for moving targets and/or where the target is obscured partially by moving machinery.

The Peak Picker time function utilises the following features:

Mode - In *'Reset'* mode, at the end of the 'OFF' delay the temperature output signal falls to 'under-range', until the temperature input next rises above the threshold level. In *'Hold'* mode, at the end of the 'OFF' delay the temperature output value is held constant until the temperature input next rises above the threshold level.

Threshold - Temperature above which the Peak Picker is active, used in conjunction with the ON and OFF delay. (Tmin° to Tmax°)

Decay Rate - A user-adjustable value at which the stored temperature output signal decays.

ON Delay - Time period between the temperature rising above the threshold level and the peak picker function switching on.

OFF Delay - Time period between the temperature falling below the threshold level and the peak picker function switching off.
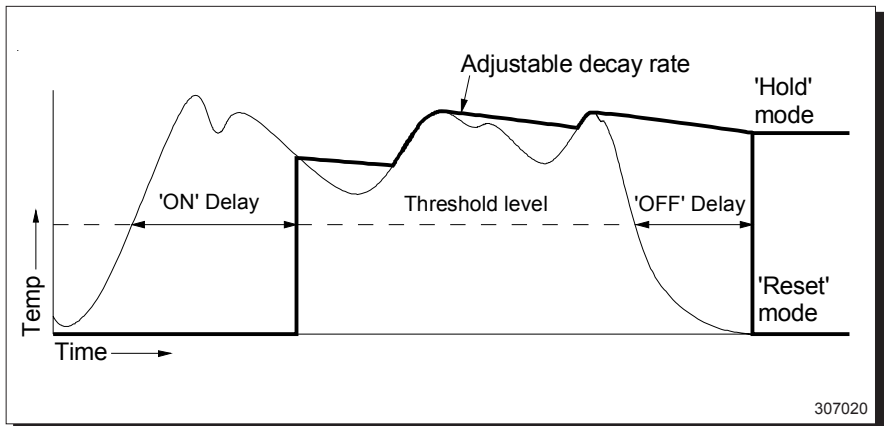

Fig. 20 - Graphical Representation of the Peak Picker Time Function

6.3   Track and Hold

The Track and Hold time function is useful especially for measuring intermittent processes e.g. items on a conveyor belt. The presence of a 'hot' object can be used to activate the 'Track' function, which causes the output to display the temperature of the object. When the object moves from the measurement area, the 'Track' function can be switched off and the temperature value held until the next 'hot' object appears. The 'Track and Hold' function function is controlled via the CMD (Command) input. The CMD input connections and operation are shown in Fig. 22 and Fig. 23.
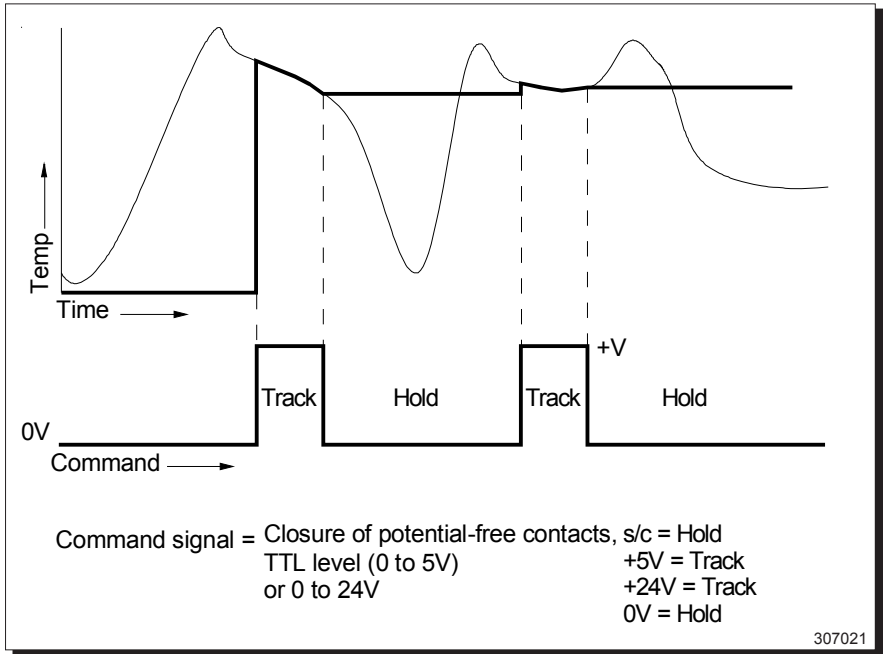

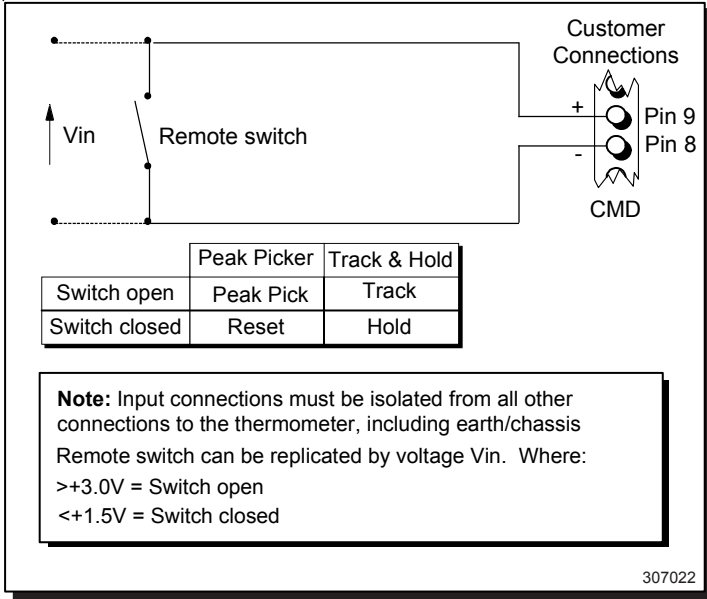Fig. 21 - Graphical Representation of the Track and Hold Time Function

	Peak Picker	Track & Hold
Switch open	Peak Pick	Track
Switch closed	Reset	Hold

Note: Input connections must be isolated from all other connections to the thermometer, including earth/chassis

Remote switch can be replicated by voltage Vin. Where:

>+3.0V = Switch open

<+1.5V = Switch closed

307022

Fig. 22 - 'CMD' (Command) Input Control via a Remote Switch

	Peak Picker	Track & Hold
Open circuit	Peak Pick	Track
Short circuit	Reset	Hold

Note: Input connections must be isolated from all other connections to the thermometer, including earth/chassis

Potential-free contacts can be replicated by voltage Vin. Where:

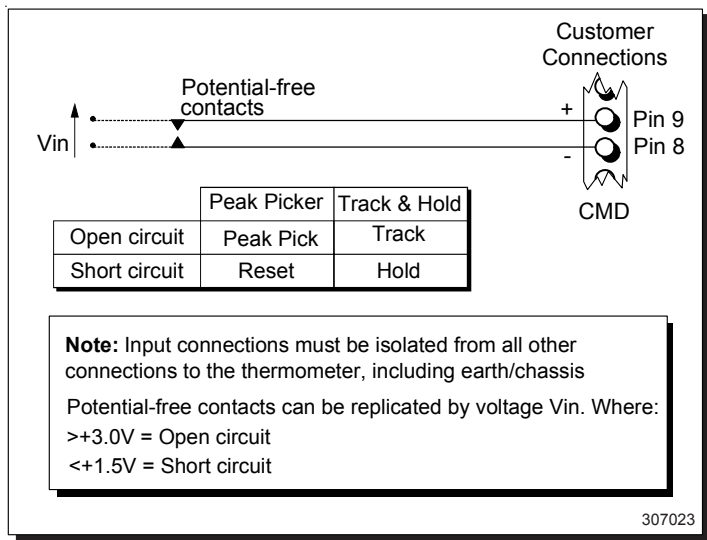>+3.0V = Open circuit

<+1.5V = Short circuit

307023

Fig. 23 - 'CMD' (Command) Input Control via Potential-free Contacts

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7.0 EMISSIVITY

In order to obtain accurate temperature measurements, the emissivity value of the target surface must be known. This section of the *SOLOnet* User Guide contains typical emissivity values of the most commonly measured materials for each thermometer variant. Where no emissivity value is quoted, this means that either the thermometer is not suitable for the measurement application or the temperature of the target is outside the thermometer's measurement span. If you have a query regarding the emissivity of the target in your measurement application, contact Land Instruments International for assistance.

7.1 Refractories

REFRACTORIES		SOLOnet Variant	
Material		SN11	SN21
Alumina		0.30	0.30
Brick	Red	0.80	0.80
	White Refractory	0.30	0.35
	Silica	0.55	0.60
	Sillimanite	0.60	0.60
Ceramics		0.40	0.50
Magnesite		-	-

307024

Fig. 24 - Typical Emissivity Values for Refractories

7.2 Alloys

ALLOYS		
Material	**SOLOnet Variant**	
	SN11	**SN21**
Brass	0.20	0.18
Oxidised	0.70	0.70
Chromel & Alumel	0.30	0.30
Oxidised	0.80	0.80
Constantin & Manganin	0.25	0.22
Oxidised	0.65	0.60
Inconel	0.30	0.30
Oxidised	0.85	0.85
Monel	0.25	0.22
Oxidised	0.70	0.70
Nichrome	0.30	0.28
Oxidised	0.85	0.85

307025

Fig. 25 - Typical Emissivity Values for Alloys

7.3   Metals

METALS	SOLOnet Variant	
Material	**SN11**	**SN21**
Aluminium	0.13	0.09
Oxidised	0.40	0.40
Chromium	0.43	0.34
Oxidised	0.75	0.80
Cobalt	0.32	0.28
Oxidised	0.70	0.65
Copper	0.06	0.05
Oxidised	0.85	0.85
Gold	0.05	0.02
Iron & Steel	0.35	0.30
Oxidised	0.85	0.85
Lead	0.35	0.28
Oxidised	0.65	0.65
Magnesium	0.27	0.24
Oxidised	0.75	0.75
Molybdenum	0.33	0.25
Oxidised	0.80	0.80
Nickel	0.35	0.25
Oxidised	0.85	0.85
Palladium	0.28	0.23
Platinum	0.27	0.22
Rhodium	0.25	0.18
Silver	0.05	0.04
Oxidised	0.10	0.10
Tin	0.40	0.28
Oxidised	0.60	0.60
Titanium	0.55	0.50
Oxidised	0.80	0.80
Tungsten	0.39	0.30
Zinc	0.50	0.32
Oxidised	0.60	0.55

307026

Fig. 26 - Typical Emissivity Values for Metals

7.4 Miscellaneous

MISCELLANEOUS				
Material		**SOLOnet Variant**		
		SN11	**SN21**	**SN51**
Asbestos (board / paper / cloth)		0.90	0.90	-
Asphalt		0.85	0.85	-
Carbon	graphite	0.85	0.85	-
	soot	0.95	0.95	-
Cement & Concrete		0.65	0.70	-
Cloth (all types - close weave) [Open weave reduces emissivity]		0.75	0.80	-
Glass	3mm thick	-	-	0.96
	6mm thick	-	-	0.96
	12mm thick	-	-	0.96
	20mm thick	0.80	-	0.96

307027

Fig. 27 - Typical Emissivity Values for Miscellaneous Materials

8.0   SN-W/E INSTALLATION TO DIN RAIL

The Land *SOLOnet* SN-W/E Interface Unit is designed to be DIN rail mounted. The following instructions detail the correct method for the mounting and removal of a unit to a standard DIN rail.
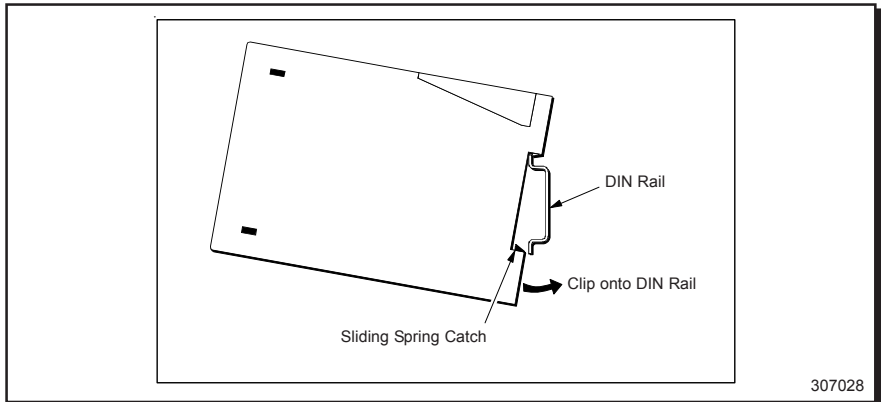
8.1   Mounting to a DIN Rail

Fig. 28 - Mounting a SN-W/E Interface Unit to a Standard DIN Rail

- Ensure that the DIN rail to be used meets the standard specification (DIN EN 50 022).

- Rest the uppermost groove on the rear of the interface unit onto the top lip of the DIN rail (see Fig. 28).

- Push the bottom of the interface unit onto the DIN rail, ensuring that the sliding spring clip latches over the rail edge.

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8.2   Removal from a DIN Rail

Use Screwdriver to
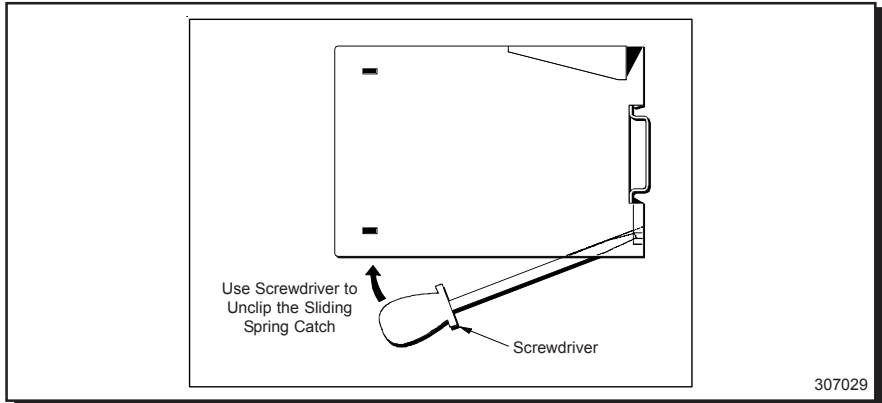Unclip the Sliding
Spring Catch

Screwdriver

307029

Fig. 29 - Removing a SN-W/E Interface Unit from a Standard DIN Rail

- Insert a flatblade screwdriver into the sliding spring catch, via the slot on the underside of the unit (see Fig. 29).

- Lever the sliding spring catch downwards so that it disengages from the DIN rail.

- Lift the interface unit from the DIN rail.

9.0   MAINTENANCE, SERVICING & CALIBRATION

SOLOnet thermometers do not have any user serviceable parts and therefore they require only minimal maintenance to ensure trouble-free operation.

The following information should be used in conjunction with that found in the *SOLOnet* Mountings and Accessories Installation Guide (PP310).

9.1   Maintenance

Although *SOLOnet* thermometers require no regular maintenance programme, it is essential that they are kept clean and free from contaminants at all times.

Particular attention to lens cleanliness is a must, to ensure accurate thermometer operation.

Where environmental accessories are utilised, the services provided to them must comply with the recommendations detailed in Land publication PP310. To promote good working practice, it is also recommended that thermometer cleanliness and services integrity checks should be added to any local plant maintenance schedule.

9.2   Servicing

SOLOnet thermometers do not incorporate user serviceable parts, therefore in the unlikely event of an instrument malfunction, or an instrument requiring servicing or calibration, contact Land Instruments International for information regarding the 'return to manufacturer' policy.

9.3   Calibration

SOLOnet thermometers are inherently stable with time. However, in line with any local quality assurance procedures, it is highly recommended that they are calibration checked every 12 months. This ensures that the instrument operates with accuracy and reliability.

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APPENDIX A

Install 'Java Runtime' Environment

To allow interaction between the web interface program and any laptop or PC connected to it, a 'Java Runtime' Environment must first be installed, via a free download from the 'Java' website or from the supplied CD.

•   From Internet Explorer, access the 'Java' website at *www.Java.com.*

•   Follow the download instructions.

APPENDIX B

'Peer to Peer' Connection

To allow direct (non-network) interaction between the web interface program and any laptop or PC connected to it, a 'Peer to Peer' connection must first be established. This requires disabling the 'Proxy Server' from the system, allowing direct IP addressing (Internet Protocol - TCP/IP) between the laptop/PC and the SN-W/E interface unit. The following instructions detail how to set the IP address of the **SOLOnet** instrumentation (static addressing) from within a Windows XP operating System and how to disable the 'Proxy Server' from 'Internet Explorer'.

•   From the Windows XP desktop, click *'Start'*.

•   Choose *'Control Panel'*.

•   Double-click on *'Network Connections'*.

•   Identify the network adapter in use (typically *'Local Area Connection'*).

•   Right-click on *'Local Area Connection'*.

•   Choose *'Properties'*.

•   Highlight *'Internet Protocol (TCP/IP)'*.

•   Click *'Properties'*.

•   Select *'Use the following IP address'*.

•   Enter the IP address given with the **SOLOnet** SN-WE interface unit and add 1 to the last number of the IP address,
          ie.   10.1.30.178 (**SOLOnet** IP address)
                   10.1.30.179 (IP address to be entered).

•   Set the *'Subnet Mask'* to **255.255.0.0** (default) or identical to the SN-W/E and ensure that the *'Default Gateway'* is blank.

•   Click *'OK'* and *'OK'* again.

•   Close *'Control Panel'*. The settings are automatically applied.

To disable the 'Proxy Server' option;

•   From the *'Start'* menu, select *'Internet Explorer'*.

•   Click the *'Tools'* tab.

•   Choose *'Internet Options'*.

•   Click the *'Connections'* tab.

•   Click on *'LAN Settings'*.

- In the 'Proxy Server' options, ensure that the *'Use a Proxy Server for your LAN (These settings will not apply to dial-up or VPN connections)'* is not checked. When this option is unchecked, the address and port options are disabled.

- Click *'OK'*.

- Click *'Apply'* and *'OK'*.

- Close *'Internet Explorer'*.

> **ℹ Note**
>
> In different versions of 'Internet Explorer', some 'Proxy Server' options may differ from options detailed in Appendix B.

If a dynamic address system (DHCP) is to be utilised, when in the *'Properties'* screen, select:

'Obtain an IP address automatically' and *'Obtain DNS server address automatically'*

> **ℹ Note**
>
> If the network operates MAC Address filtering, the MAC Address must first be added to the network configuration.
>
> The MAC Address for the **SOLOnet** SN-WE is located on the instrument serial No. label.
>
> Contact your local Network Manager for further information.

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APPENDIX C

RS485 - Land Protocol

This is a multi-drop, 4-wire, RS485 serial protocol. It requires the SOLOnet address to be set from 1 to 254. Addresses 0 and 255 always get a response, therefore in multi-drop applications these must not be used.

COMMAND STRUCTURE

{STX}{Address}{Report/Set}{Channel}{Command}{Space}{Value}{ETX}

{STX}   single value hex value 0x02
{Address} single character value of designated address - serial port adjustable 1 to 254
{ETX}   single character hex value 0x03

(Do not use CR between STX/ETX brackets)

RESPONSE STRUCTURE

{STX}{Address}{Response}{CR}{LF}{ETX} Single line replies

{STX}{Address}[start]{CR}{LF}   Multi-line replies

{line1}{CR}{LF}

{line2}{CR}{LF}

etc ..

[end]{CR}{LF}{ETX}

(All features have meanings as Command Structure)

NOTE:

If the EKO command is used to set the reply on, when values are changed the unit responds with the following:

{STX}{Address}{Response}{CR}{LF}{ETX} where the response is the mnemonic of the message sent plus a 1.

e.g.   With EKO set to 1

(message sent from user to set emissivity to 0.999)

{STX}
0x01   address
'S'
'A'
'E'
'M'
'S'

'9'
'9'
'9'
{ETX}

The reply from the unit is:

{STX}
0x01   address
'E'
'M'
'S'

' 1'
' CR'
' LF'
{ETX}   confirmation of change

RS485 - 'Read Data'
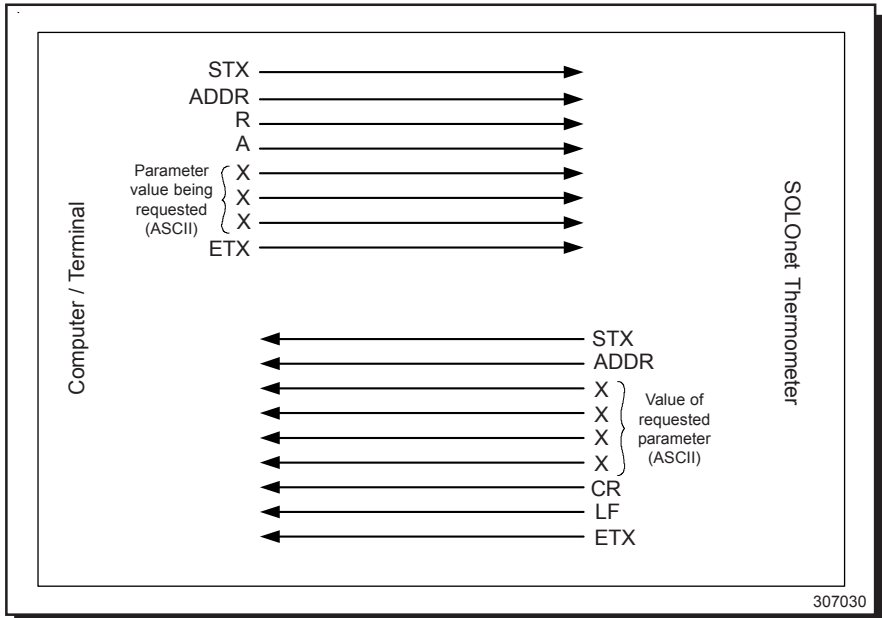
Fig. 30 - RS485 'Read Data' Protocol

RS485 - 'Set Data'

STX
ADDR
S
A

Parameter value being modified (ASCII)
X
X
X

SPACE

New parameter value (ASCII)
X
X
X
X

ETX

Computer / Terminal

SOLOnet Thermometer

307031
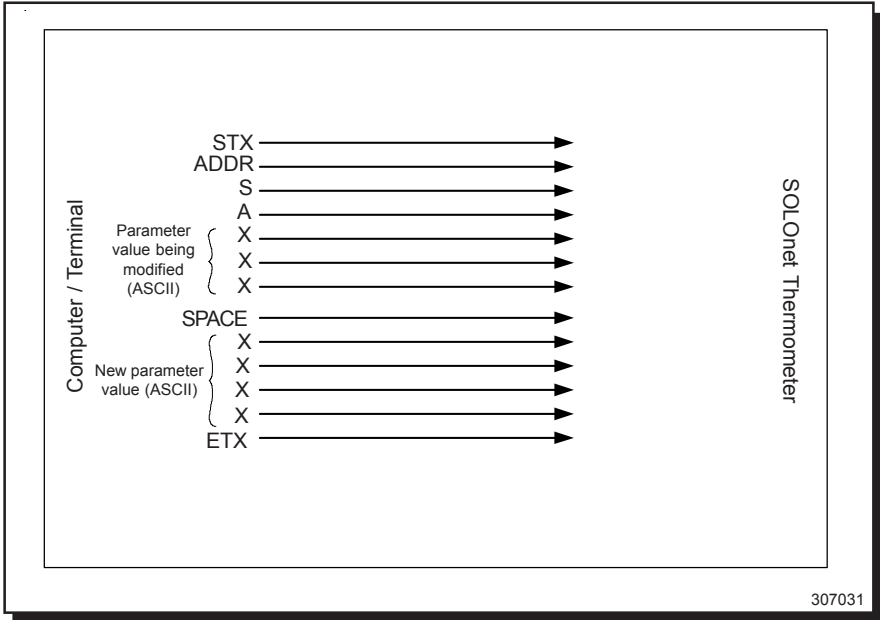
Fig. 31 - RS485 'Write Data' Protocol

User Accessible Commands

Changing parameters causes the processor to set the new parameter value on its next task cycle. The new value is held in volatile system RAM and will be lost if the processor is powered off.

A command is provided to commit configuration parameter changes to system non volatile memory. This separate 'save' command provides the following:

1. Adjustment of the processor settings while the system is operating until an optimised configuration is achieved.
2. An infinite number of processor reconfigurations for a dynamic application (e.g. changing emissivity or alarm trip levels, etc) without wasting the finite (10,000) erase cycles of the onboard EEPROM non volatile memory.

CMD	Function	READ response	SET example	Range	Resolution	Default	Comments
A1L	Alarm1 trip level	**1600**	**SAA1L 1000**	IRTmIn-max	1°	IRTmax	
A1M	Alarm1 mode	**0003**	**SAA1M 1**	0,1, 2, 3, 4	-	1	0 = Low alarm 1 = High alarm 2 = Int. amb. 3 = Emiss. lost 4 = Dirty window (ratio only)
A1S	Alarm1 status	**0000**	N/A	0,1	-	-	0 = Not tripped 1 = Tripped
A1C	Alarm1 contact	**0000**	**SAA1C 1**	0,1	-	-	0 = NO contacts 1 = NC contacts
AB1	Amb.1 trip level	**70**	**SAAB1 70**	70 max	1°	70 max	
A2L	Alarm2 trip level	**1600**	**SAA1L 1000**	IRTmIn-max	1°	IRTmax	
A2M	Alarm2 mode	**0003**	**SAA1M 1**	0,1, 2, 3, 4	-	1	0 = Low alarm 1 = Highalarm 2 = Int. amb. 3 = Emiss. lost 4 = dirty window (ratio only)
A2S	Alarm2 status	**0000**	N/A	0,1	-	-	0 = Not tripped 1 = Tripped
A2C	Alarm2 contact	**0000**	**SAA2C 1**	0,1	-	-	0 = NO contacts 1 = NC contacts
AB2	Amb.2 trip level	**70**	**SAAB1 70**	70 max	1°	70 max	

User Accessible Commands (continued)

CMD	Function	Read Response	Set Example	Range	Resolution	Default	Comments
AVR	Averager resp. time	**0001**	**SAAVR 12**	0-15	1	0001	Intervals: 0000 0s 0001 50ms 0002 100ms 0003 150ms 0004 250ms 0005 500ms 0006 1s 0007 2s 0008 4s 0009 8s 0010 16s 0011 32s 0012 64s 0013 128s 0014 256s 0015 512s
BRT	485 baud rate	**0000**	**SABRT 1**	0	1	57600	
COM	Com protocol	**0000**	**SACOM 1**	1-254	1	1	1-254 = RS485 address. Protocol and address set by hardware.
EMS	Emissivity	**400**	**SAEMS 400**	100-1000	1	1000	100 = 0.100 1000 = 1.000 (Std. IRT selected)
NGR	NonGreyness	**1000**	**SANGR 1100**	800-1250	1	1000	800 = 0.800 1250 = 1.250 (Ratio IRT selected)
FLG	Status flags	**0x0020**	N/A	0x0000-0xFFFF	-	-	**Bit Function Set Clr** 0 Ratio IRT Active Ratio irt 1 Laser flag Active Not Act. 2 Bobbin temp Active Not Act. 3 Comm'd I/P Active Not Act. 4 Under range Active OK 5 Over range Active OK 6 Obscured Active OK 7 Clipping Active OK 8 Sensor fail Active OK 9 Alarm1 Active OK 10 Alarm2 Active OK 11 Emiss Alarm Active OK 12 Sensor CRC Inactive OK 13 Output CRC Inactive OK 14 Calib. CRC Inactive OK 15 Config. CRC Inactive OK
PSW	Password	**SOLONET**	N/A	alphanumeric	-	-	
IRU	Units	**0000**	**SAIRU 1**	0,1	-	-	0 = ºC 1 = ºF
UAP	Single point	**0000**	**SAUAP 1000**	800 -1200	-	1000	1000 = 0
IFO	Information	***see below***	N/A	0-2	1	-	0 = Processor 1 = IRT 2 = Config 3 = Land

User Accessible Commands (continued)

The use of text based flags is designed specifically for use with a Windows-based configuration tool. The flags are also compatible with terminal programs. This is used to transfer the data directly into sequential files, under Windows, for subsequent manipulation. This simple protocol is very flexible and expandable.

For example:

RAIFO 0	*Processor Identification report - text strings<x chars*		
	[start]	**[start]**	
	Processor Information	**[Processor Information]**	
	Processor identifier	**Solonet**	
	Application code version	**Appl Code: V 1.00 or Zxxxx**	
	Hardware identifier	**Hardware ID : 0xF0**	
	[end]	**[end]**	

RAIFO 1	Current thermometer Details *report - formatted strings NN⊗ : SN x r y or SNzt xxxx*		
	NN = index 00-10 SN = SoloNet x = wavelength ⊗ = space		
	r = 0 - 9 y = laser or ZTxxxx Specials No.		
	[start]	**[start]**	
	[Thermometer Information]	**[Thermometer Information]**	
	Index: Type	xx	**00 : LN1 (test purposes only)**
			01 : SN1
			02 : SN2
			03 : SN5
			04 : SNR1
	Thermometer Units of operation	**IRU xxxx**	0 = ºC , 1 = º F
	Thermometer Temperature Maximum	**THV xxxx**	value dependent on above & units
	Thermometer Temperature Minimum	**TLV xxxx**	Value dependent on above & units
	Laser present	**LPF xxxx**	1 = laser fitted
	[end]	**[end]**	

RAIFO 2	*Configuration report - text strings CMD NNNN*	
	[start]	**[start]**
	[Configuration information]	**[Configuration information]**
	Label	**LBL SOLOnet X**
	Thermometer	**IRT 0001**
	Emissivity	**EMS 1000**
	Nongreyness	**NGR 1000**
	Timefunction	**TFN 0000**
	Averager constant	**AVR 0001**
	PeakPick Mode	**PPM 0000**
	PeakPick threshold	**PPT 0500**
	Peakpick OnDelay	**PON 0000**
	Peakpick OffDelay	**POF 0010**
	Peakpick Decay constant	**PPD 0012**
	Alarm 1 Level	**A1L 1700**
	Alarm 1 Mode	**A1M 0001**
	Alarm 1Contact mode	**AC1 0001**
	Alarm 2 Level	**A2L 1700**
	Alarm 2 Mode	**A2M 0001**
	Alarm 2 Contact mode	**AC2 0001**
	Output max	**OMX 1700**
	Outputmin	**OMN 0500**
	Output mode	**OPT 0000**
	[end]	**[end]**

User Accessible Commands (continued)

	RAIFO 3	*Contact report - text strings<x chars*

[start]	**[start]**
[Contact information]	**[Contact information]**
Land	**Land Instruments International**
Address	**Dronfield S18 1DJ, UK**
Tel	**Tel: +44 (0)1246 417691**
[end]	**[end]**

CMD	Function	Read Response	Set Example	Range	Resolution	Default	Comments
IRT	Thermometer	**01: SN11**	**SAIRT 0001**	0000-xxxx	1	0001	Range found using IFO1 command. NOTE: SET will reset all processor configurable parameters to default values.
LBL	Processor label	**Solonet xx**	**SALBL Solonet**	alphanumeric-		"Solonet X"	Max 15 characters
MEM#	Memory	**0000**	**SAMEM 1101**	0000-9999	1	0000	Rd resp 0000 RAM=EEPROM 0001 RAM≠EEPROM Flag is set when user has changed a config. parameter, but not yet saved. Processor uses parameters that will be lost at power off. Set arg 1101 Save RAM>EEPROM i.e. Save configuration 9999 Move EEPROM>RAM i.e. Restore config. from EEPROM. See also REFresh for saving EEPROM>RAM
OBS	Obscuration	**0000**	**N/A**	0,1	-	-	0 = not obscured 1 = obscured Ratio IRTs only. Not NAMUR 43 compliant.
IAC	Intl amb. (selected IRTs)	**35C**	**N/A**	-	-	-	Internal ambient thermometer temp.
ANC	Analog control	**1**	**SAANC 1**	0,1	1	1	Analog emissivity control 1 = analog, 0 = digitial
OMN	Iout min temp	**500**	**SAOMN 700**	IRTmin>(max-50)	1°	IRTmin	Must also be 50° below Iout max
OMX	Iout max temp	**1700**	**SAOMX 1500**	(IRTmin+50)>max	1°	IRTmax	Must also be 50° above Iout min
OPT	Iout scale	**0000**	**SAOPT 1**	0,1	-	1	0 = 0-20mA, 1 = 4-20mA
LSR	Laser Control	**0000**	**SALSR 1**	0,1	0	0	1 = laser on Auto turn off
OVR	Overrange	**0000**	**N/A**	0,1	-	-	0 = in range 1 = over range

User Accessible Commands (continued)

CMD	Function	Read Response	Set Example	Range	Resolution	Default	Comments
POF	Ppick Off Delay	0010	SAPOF 20	0-100	1	10	100 steps of 0.1secs
PON	Ppick On Delay	0000	SAPON 10	0-100	1	0	100 steps of 0.1 secs
PPD	Ppick Decay Rate	0012	SAPPD 1	0-15	1	0012	Interval: 0000 0°/s 0001 250m°/s 0002 500m°/s 0003 1°/s 0004 2°/s 0005 4°/s 0006 8°/s 0007 16°/s 0008 32°/s 0009 64°/s 0010 128°/s 0011 256°/s 0012 512°/s 0013 - 0014 - 0015 -
PPM	Ppick Mode	0000	SAPPM 1	0,1	-	0	0 = reset, 1 = hold
PPT	Ppick Threshold	500	SAPPT 1000	IRTmln-max	1°	IRTmin	
REF	Refresh	0000	SAREF 1	0,1	-	0	0 = refreshON, 1 = refreshOFF Refresh cal/confg E²Prom to RAM every task cycle. NOTE: Changing a config parameter switches refresh off and MEM flag to 1. NOTE: Switching refresh to ON sets MEM flag to 0. i.e. RAM=E²Prom.
TFN	Time Function	0001	SATFN 2	0-3	1	0	0000 = No time function selected 0001 = Averager 0002 = Peak picker 0003 Track & hold
TMP	Temperature	973	N/A	(IRTmin1)>(max+1)	1°	-	
HTP	Temperature in 16 T	15568	N/A	(IRTmin-1)>(max+1)	1/16°	-	
UDR	underrange	0000	N/A	0,1	-	-	0 = inrange 1 = underrange
BTP	Bobbin temp.	55	N/A	-	16T	-	Ratio bobbin temp. 'C
TLV	Irt min temp	500	N/A	IRTmin	-	IRTmin	IRT range fixed
THV	Irt max temp	1700	N/A	IRTmax	-	IRTmax	IRT range fixed
LPF	Laser fitted flag	0001	N/A	0,1	-	1	Laser fitted = 1
VER	Software version	String	N/A	-	-	-	e.g. APP code: V1.01

User Accessible Commands (continued)

CMD	Function	Read Response	Set Example	Range	Resolution	Default	Comments
HCD	High level cal date	51	SAHCD 51	year, quarter	-	-	e.g. 51 is 2005 quarter 1
EKO	Reply enable flag	0001	SAEKO 1	0,1	-	0	Change message reply enable