DTSCM2 USER MANUAL

DISTRIBUTED TEMPERATURE SENSING

Bandweaver Product Family: **T-Laser & FireLaser**

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Revision History

Rev	Date	Reason for issue	Author	Reviewer	Reviewer
1	21-Jun-2019	First issue	E. Fernandes	R. Da Costa	E. Fernandes
2	20-July-2020	Updated DTSCM2 screenshots, notes about change rate algorithm, and double-ended functionality	R. Da Costa	Liu Jin	E. Fernandes

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1 Overview

The T-Laser and FireLaser range of temperature sensing systems usually consist of a Distributed Temperature Sensing unit and a computer with DTSCM2 software installed. However, the DTS can also operate independently of DTSCM2. This manual mainly introduces the configuration and use of DTSCM2 software, as well as some common problems that may occur in the use of this product.

It should be read in conjunction with the relevant hardware Installation, Operation and Maintenance Manual, which details the use of the hardware and any associated safety warnings:

- **DTS-FL-03-MAN-001** - FireLaser Installation, Operation and Maintenance Manual
- **DTS-TL-02-MAN-001** – T-Laser Installation, Operation and Maintenance Manual

DTSCM2 software can be used with the following models of the FireLaser and T-Laser product. The product model number may be found on the nameplate on the back of the sensor.

FireLaser

- DTS-FL-03-02-1CH
- DTS-FL-03-02-2CH
- DTS-FL-03-02-4CH
- DTS-FL-03-05-1CH
- DTS-FL-03-05-2CH
- DTS-FL-03-05-4CH
- DTS-FL-03-10-1CH
- DTS-FL-03-10-2CH
- DTS-FL-03-10-4CH

T-Laser

- DTS-TL-02-10-4CH
- DTS-TL-02-10-8CH
- DTS-TL-02-16-4CH
- DTS-TL-02-16-8CH
- DTS-TL-02-20-4CH
- DTS-TL-02-20-8CH
- DTS-TL-02-30-4CH
- DTS-TL-02-30-8CH
- DTS-TL-02-40-4CH
- DTS-TL-02-40-8CH

For other models, or if you are unsure of the model you own, please check with your local Bandweaver representative.

1.1 Abbreviations and Terminology

DTSCM2	Distributed Temperature Sensor Configuration and Monitoring software Ver. 2
DTS	Distributed temperature sensing system
CPU	Computer Processing Unit
Modbus	A communication protocol
ECP	File extension of a configuration file. Format: *.ecp2 for DTSCM2. All project parameters are saved in this file, including all initialisation information.
PC	Personal computer
IP	Internet Protocol: protocols for interconnection between networks
MAC	The physical address of the network card
HDT	File extension of a data file. Format: *.hdt

EDFA Erbium-Doped Fiber Amplifier

Zone A section of fiber that indicates the starting and ending positions.

1.2 Reference Standards

EIA/TIA 568B[1] International set of standards for network connections

IEC60825-1 Edition 1.2 E2001-03 Laser radiation grading international standards

Notes:

[1] Version in effect as of initial release of this document.

2 Quick Start

This section is meant for a Designer or Admin user to quickly setup and configure a system in the correct sequence. It refers to other sections of this manual for detailed instructions.

These later sections can be used as a reference manual for the software.

2.1 Install the DTSCM2 software

Refer to Section 3.

2.2 Log in

Log in as a Designer. Refer to Section 6.1.2.

2.3 Initialise a project or load an ECP file

The software saves the configuration of a project in a file with a .ecp2 extension. These saved configuration files are referred to as ECP files in this document.

Before the ECP file is loaded, or the project is initialised, most of the menu items are greyed out as shown in Figure 2-1

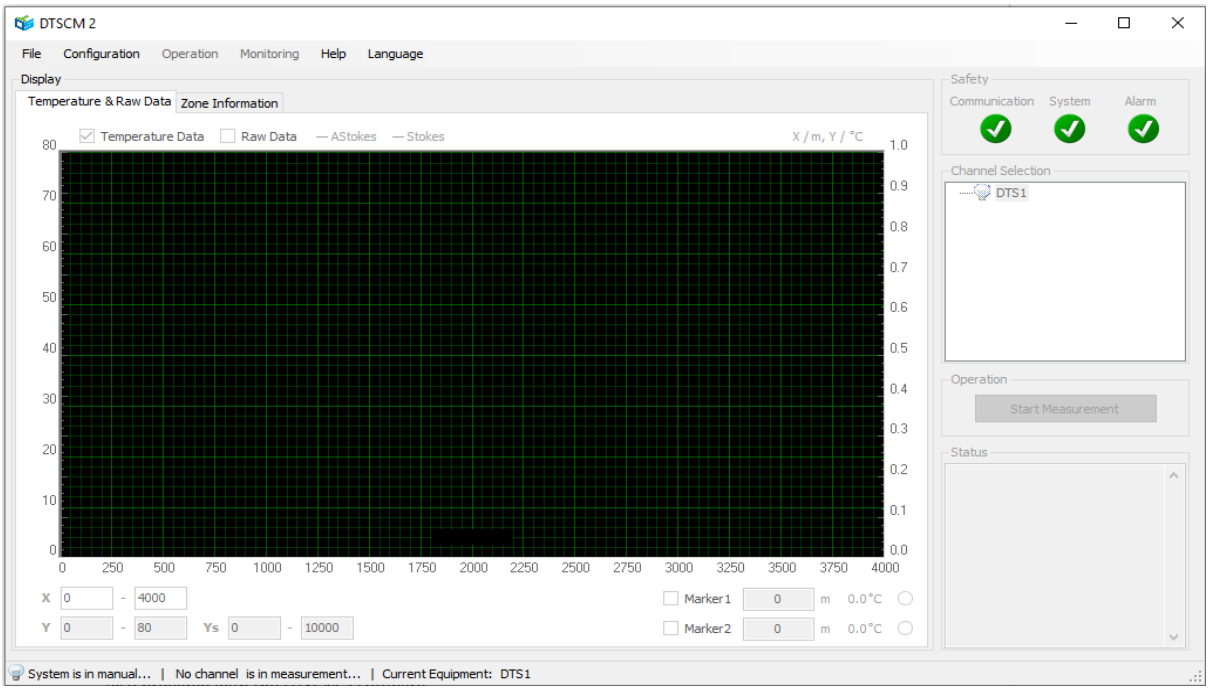


Figure 2-1 – Main interface before loading ECP file

An ECP file is supplied with each DTS unit purchased which contains the DTS configuration as set up by the factory. The file is named with the DTS serial number and the .ecp2 extension. A template is also provided with the DTSCM 2 software.

Either of these can be loaded via the ***File < Open*** menu.

To start a new project from scratch, refer to the ***Initialise*** function in Section 6.2.

Once this step is completed, most of the menu options will become operational.

2.4 Connect to the FireLaser or T-Laser DTS

Refer to FireLaser or T-Laser hardware manual specified in Section 1 for instructions and troubleshooting of the hardware connection.

Ensure the laser is off.

2.5 Connect the test fiber(s)

Connect the test fiber to the DTS unit and turn on the laser.

Refer to FireLaser or T-Laser hardware manual specified in Section 1 for details on how to use the connector and where to connect it.

2.6 Configure the Network

DTSCM2 requires proper communication configuration to connect to DTS.

Connect the PC to the DTS an RJ45 cable. The default IP address of the DTS is **192.168.0.100.**

Note:

If the user has loaded the template ECP file or the ECP file supplied with the DTS unit this step will not be required.

Ensure the IP address (see Figure 2-2) is 192.168.0.100

Note: This assumes the default detector IP address has not been modified by the customer.

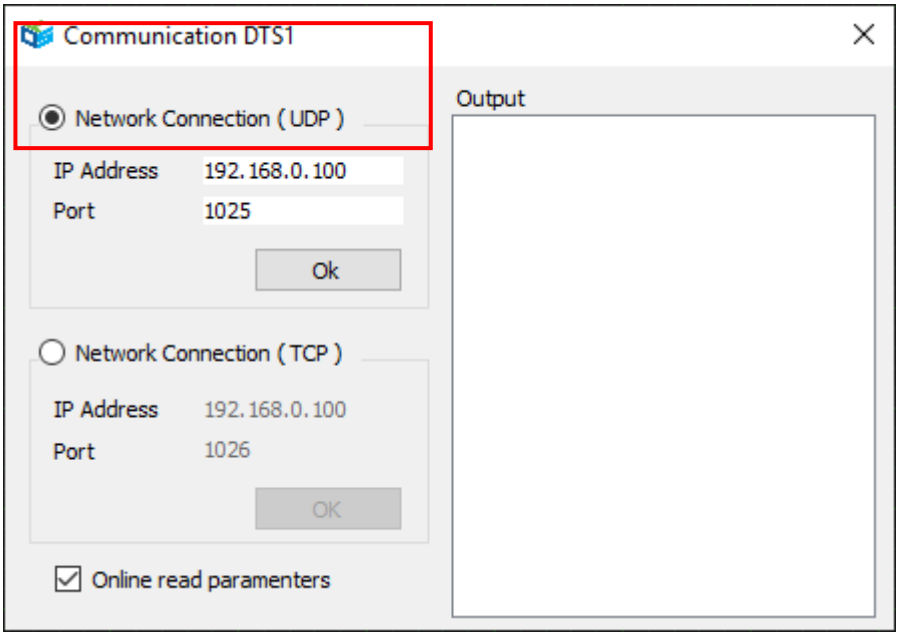


Figure 2-2 IP Address

Refer to Section 6.3 for detailed information on the settings for this menu screen.

2.7 Start the measurement

Use the Start Measurement button to Start the measurement.

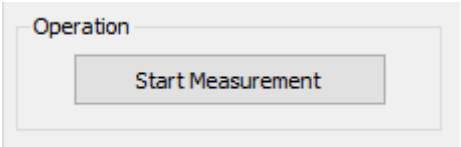


Figure 2-3 Start measurement button

Depending on the measurement time and measurement cycle, which can be configured (refer to Section 6.12), the temperature trace will appear in the Temperature & Raw Data tab of the main display.

This is the temperature measured along the configured length of the attached sensing fiber. The user can now configure the zones and alarms based on the project requirements.

2.8 Set up Zones and Alarms

Alarms are triggered by zones, so at least one zone must be set up for every channel that must output an alarm. In addition to a zone, the required alarm thresholds must be set to trigger the alarm at the appropriate event.

Considering the cable route, service loops, optical path, end user zone requirements, etc. determine the zones into which the sensing fiber will be divided. The fiber may need to be physically heated to identify the true meter points at the start and end of each zone.

- Refer to Section 6.13 to configure the Zones
- Refer to Section 6.13 to configure the Alarm Index

Calibration must be carried out at the installation site on the installed fiber.

2.9 Measuring

After the parameters are correctly configured, the DTS can be set to measure automatically or the user can stop the measurement in the ***Operation*** region of the main interface. See Section 7 Menu – Operation for details. After entering the automatic measurement, refer to the Channel Selection panel to verify the connection status of the DTS and which channel is in measurement. Refer to Section 6 Channel Selection panel for details.

After each channel is measured, the data can be displayed in the main display by clicking on the channel in the ***Channel Selection*** panel, as shown in Figure 2-4.

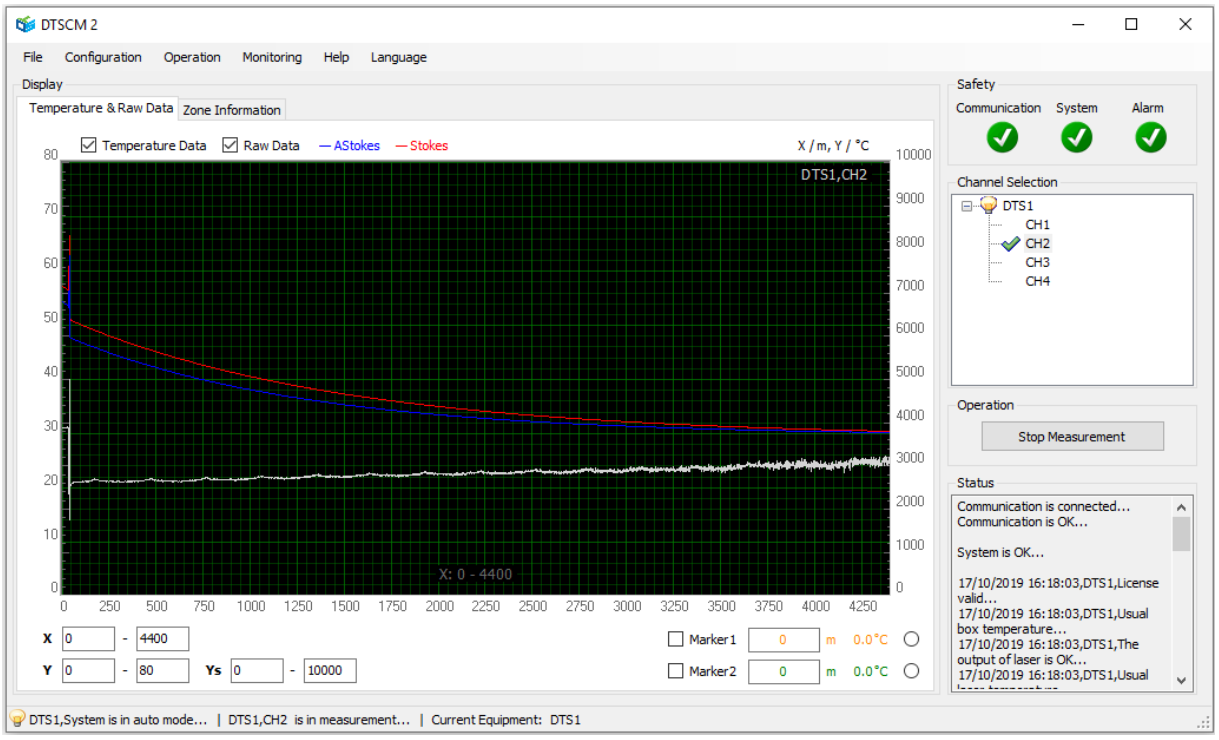


Figure 2-4 Primary measurement data and other status icons

The DTS is an embedded system that can run independently of the DTSCM 2 software.

In the absence of command intervention, DTS enters the measurement state 30 seconds after switch-on or restarting. The parameters used are those internally saved to the DTS.

It is also possible to set DTSCM 2 to automatically start the project so that the PC will automatically run DTSCM2 after start-up to achieve state and data synchronization.

All parameter configurations can only be performed while the DTS is not measuring. In addition, some operations can only work under manual operation mode, so these selections are greyed-out when the system is in automatic measurement mode. To enter manual operation mode, the user needs to stop measuring first.

Stop Measurement to enter the manual measurement state from the automatic measurement state.

The operator can now to carry out specific functions in Edit mode, and requires familiarity with configuration. Therefore, Designer or higher-level access is required via a password. The Edit mode password input dialog box is as shown in Figure 2-5.

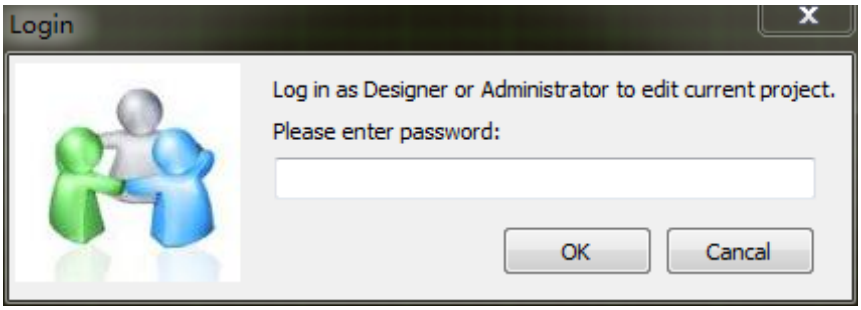


Figure 2-5 Entering password input box to edit

3 Software Installation

3.1 Required environment

DTSCM2 can operate on a 32-bit or 64-bit Windows® XP, Windows7, or Windows10 system; but Windows® XP system needs an SP2 or later installed. If the basic hardware and software environment requirements are not met, the software will not be installed or function properly. ⚠

- Windows® XP + SP2 or later / Windows7 / Windows10
- .net Framework 4.0
- Intel(R)Core (TM) I3 series CPU or better;
- 512MB or more available memory
- 2GB or more available hard disk space

3.2 Installation steps

3.2.1 Software installation

Before installing a new version of DTSCM2, make sure any previous versions (including DTSCM) have been uninstalled. Also ensure the .net Framework 4.0 is installed on the host computer. Run setup.exe under the root directory and follow the prompts of the installation wizard to complete the installation. After installation, the wizard will automatically create a shortcut on the desktop.

Figure 3-1 DTSCM 2 icon

3.2.2 Software Uninstall

Double click the uninstall shortcut in the DTSCM 2 folder root directory and follow the prompts.

3.3 Start the software DTSCM2

Double-click the DTSCM2 icon on the desktop or in the Start menu to run the software. The user can select the software language on the start screen. If no selection is made, the software defaults to the language used in the last session.
The language options are English, Chinese are Russian as shown in Figure 3-2.

Figure 3-2 Welcome Screen

4 Main Interface Window

DTSCM2 main interface has 7 functional areas, as shown in Figure 4-1.

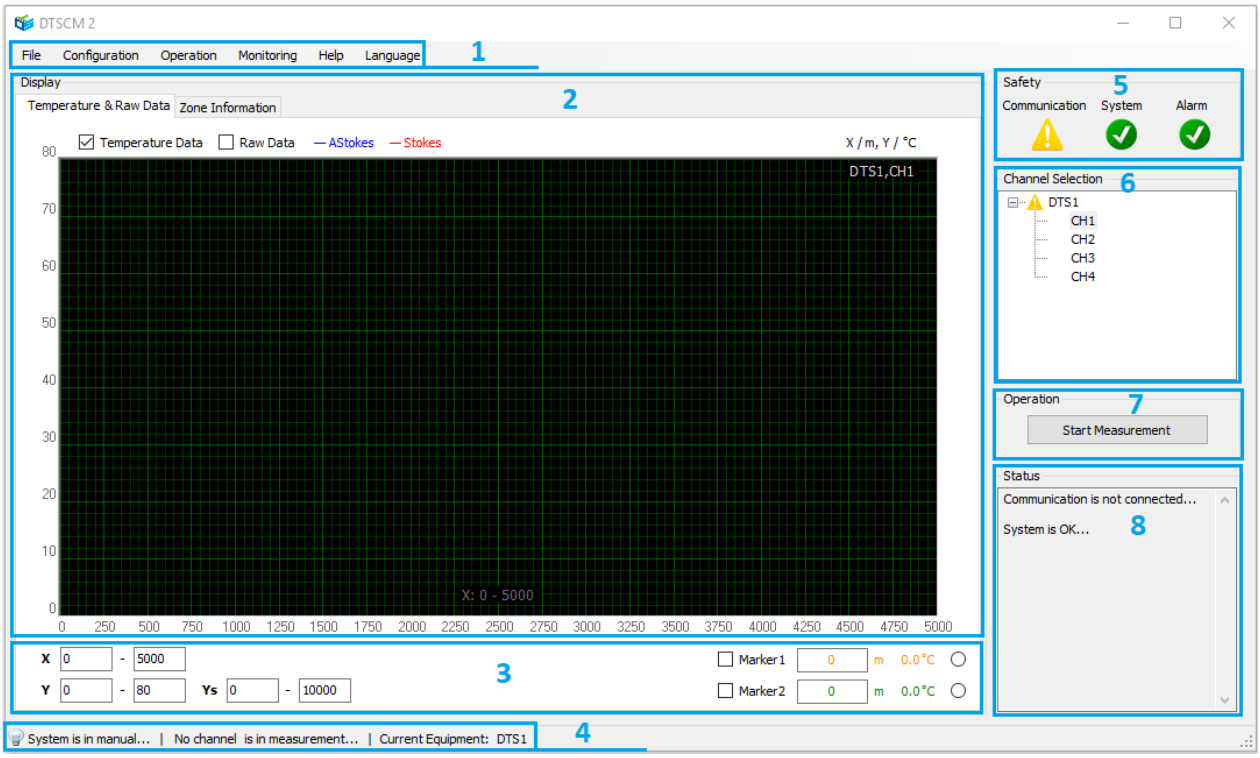


Figure 4-1 The main interface functional areas

Description of the functional areas:

1. Main Menu bar
2. Data and information display
3. Coordinate configuration
4. Status bar
5. Safety panel
6. Channel Selection panel
7. Operation panel
8. Status panel

Each of these is described in detail in the following sections.

4.1 Main Menu bar

The main menu bar has 5 main items, as shown in Figure 4-2.

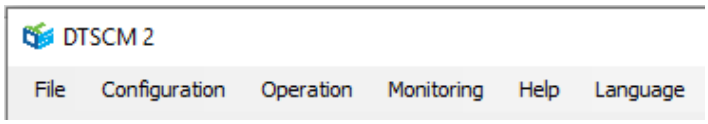


Figure 4-2 Menu Bar

4.2 Data and information display

The data and information display consists of two tabs, which can be used to access two function pages:

- Temperature & Raw Data
- Zone Information

These tabs can be seen in Figure 4-3.

Figure 4-3 Data and Information Display- temperature and the raw data

4.2.1 Temperature & Raw Data

This tab displays the temperature curve and the original curve. The user can control both data displays independently.

The temperature profile is as shown in white, while the Stokes and anti-Stokes signals of the original curve are as shown in red and blue respectively.

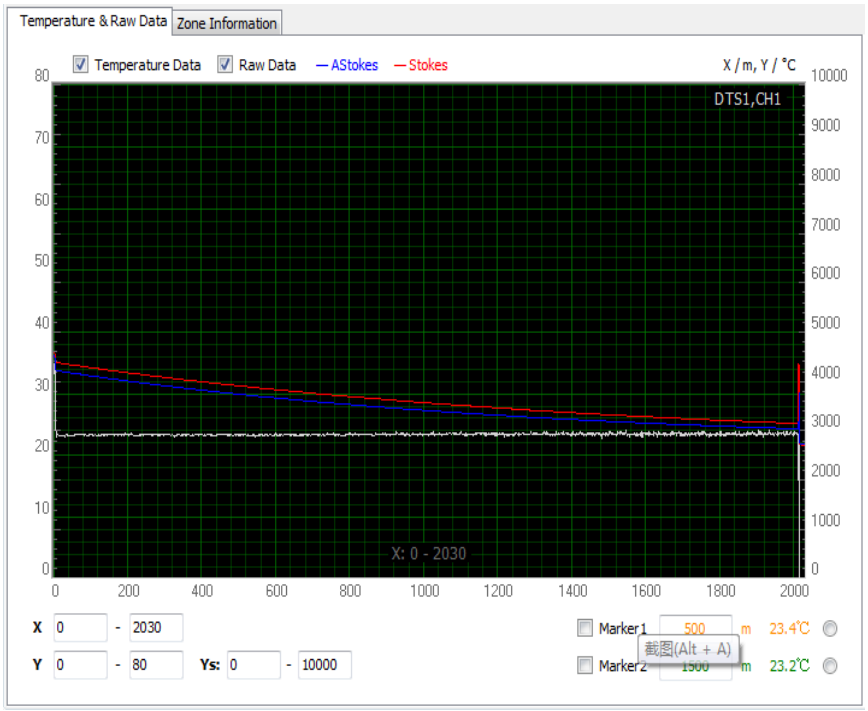


Figure 4-4 Temperature and Raw data

The user can click and drag a rectangle in the graphics display region to create dynamic or static partial windows. Static partial windows do not refresh the curve. Dynamic local window data is refreshed as the curve of the graphics region is refreshed.

Dynamic local window:

Drag the mouse from the bottom right to top left and draw a white rectangle to create a dynamic partial window. When the measurement is updated, the data displayed in the dynamic window is also updated. The dynamic window and the white rectangular selection area are as shown in Figure 4-5.

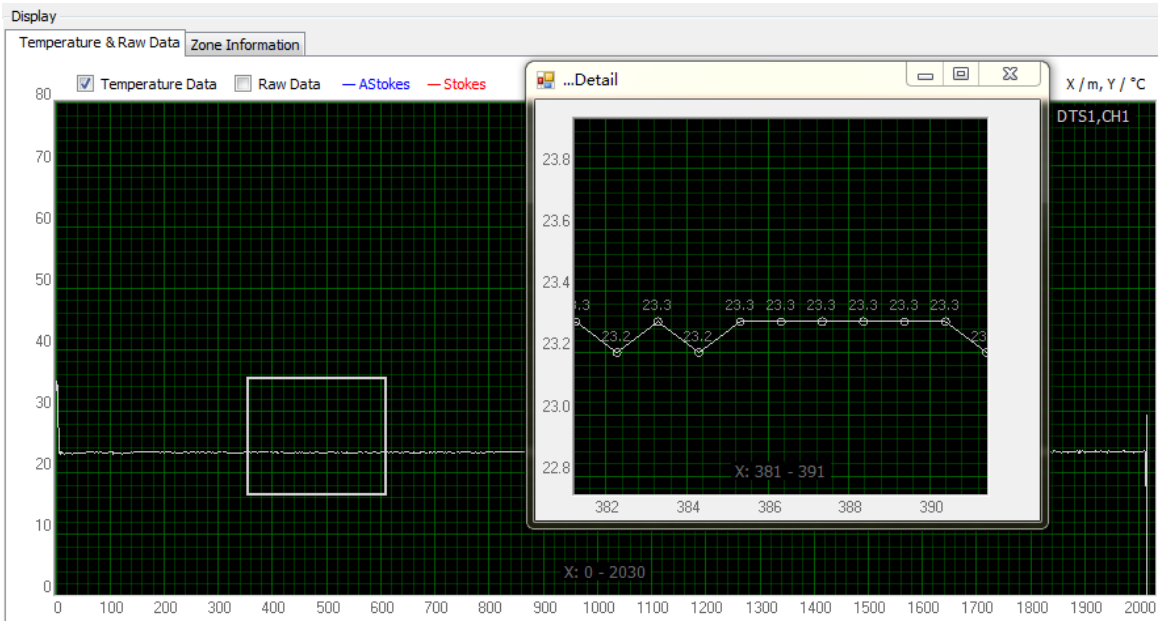


Figure 4-5 Create dynamic local window

Static local window:

Drag the mouse from top left to bottom right and draw a blue rectangle to create a static partial window. When the data is updated, the content displayed in the static partial window is not updated. The static window and the blue rectangular selection area are as shown in Figure 4-6.

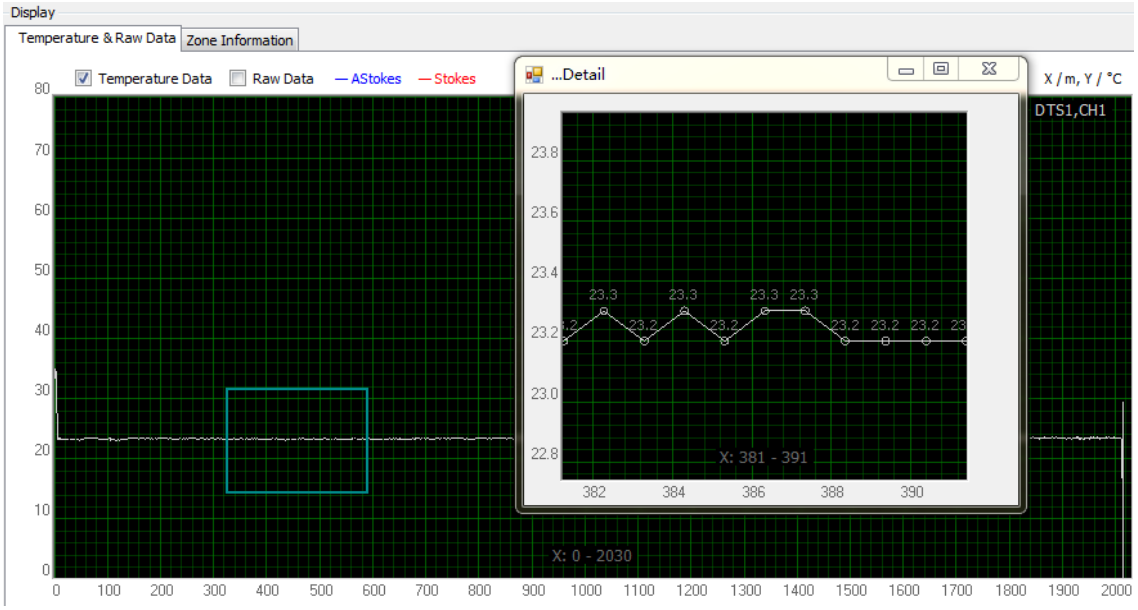


Figure 4-6 Create static local window

4.2.2 Vertical Area

Click and drag the mouse in the vertical direction only to expand the view vertically. The blue box is a static partial window, and the white box is a dynamic partial window. The dynamic and static windows in the vertical direction are as shown in Figure 4-7.

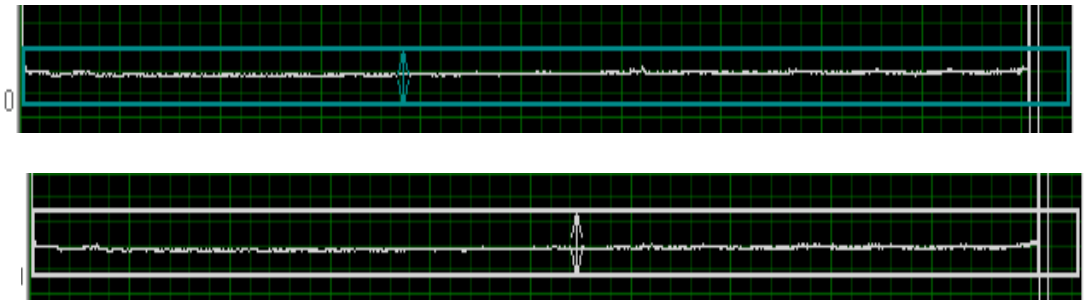


Figure 4-7 Vertical static and dynamic expansion

4.2.3 Horizontal Area

Click and drag in the horizontal direction only to expand the view horizontally. The blue box is a static partial window, and the white box is a dynamic partial window. The dynamic and static windows in the vertical direction are as shown in Figure 4-8.

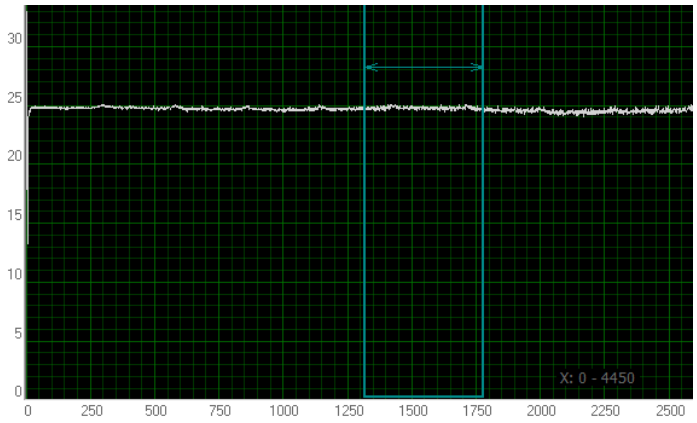


Figure 4-8 Horizon static and dynamic expansion

4.2.4 Zone Information

This tab displays the Zone information of the currently selected channel and the real-time information of the Zone.

The zone information includes the following detail: region number, region name, start, end, and the allocation of the activation state relay

Zone real time information includes every measurement update like early warning, high temperature, low temperature, rate of rise, and temperature spikes.

The values are only refreshed when the alarm type of the specified index is activated in the ***Alarm Index*** sheet.

Display

Temperature & Raw Data | Zone Information

Zone	Zone name	Zone start(m)	Zone stop...	Active	Relay	Max Alert 1(°C)	Max Alert 2(°C)	Max(°C)	Min(°C)	Change rate	Deviation(°C)
1	Zone1	5	20	true	7			23.6		0.0	
2	Zone2	21	30	true	8			23.3		0.0	
3	Zone3	31	40	true	9			23.1		0.0	
4	Zone4	41	50	true	10			23.2		0.0	
5	Zone5	51	60	true	11			23.4		0.0	

Figure 4-9 Data and Information Display – Zone information

4.3 Coordinate configuration

The user can set the axis and markers available to display the curve in a way that best suits the project requirements.

X-axis *represents the cable length*

Y-axis *represents the measured temperature*

Ys range *represents the display range of the original curve*

To save the modified X, Y, and Ys axis coordinate values so that these are the default settings the next time the project is opened, select ***File*** < ***Save*** to update the .ECP configuration file, or save the settings to a new ECP file. The next time the saved ECP file is opened, the default display coordinates will be the ones saved by the user.

The main interface also provides markers. Check the box and enter a meter position value to automatically display the temperature of the input position. Examples of the axis setting and marker usage can be seen in Figure 4-10.

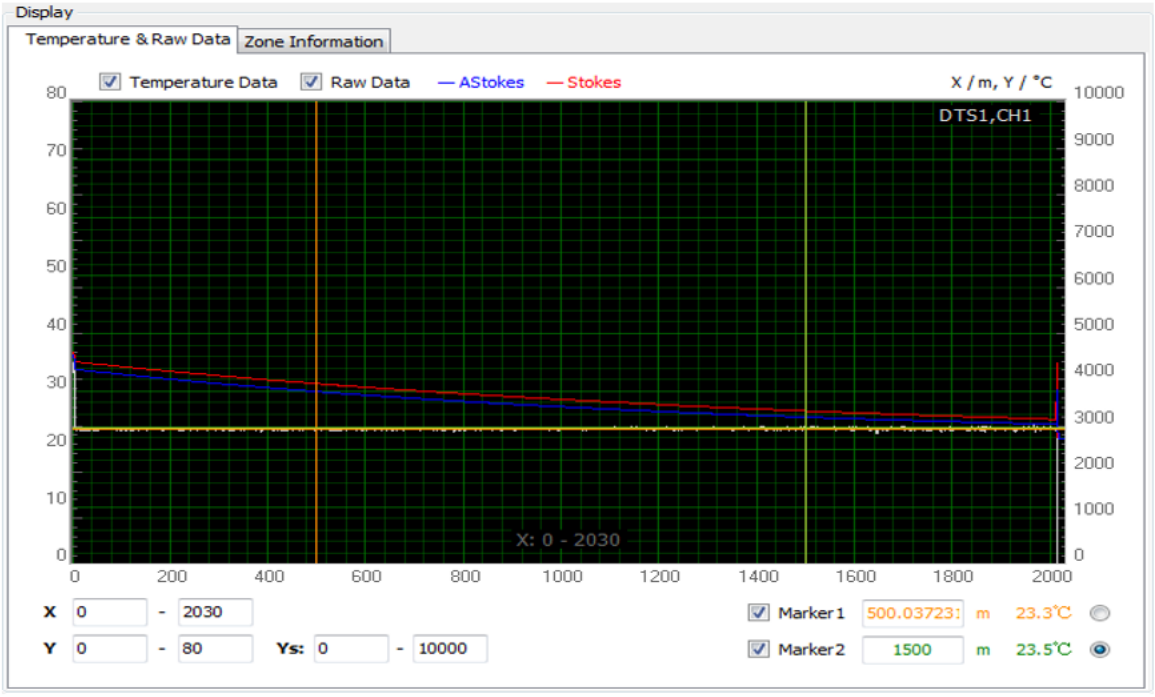


Figure 4-10 Axis adjustment and a schematic marker

4.4 Status bar

The status bar displays the measurement status of the selected device, the channel currently in measurement, and the selected device name. An example is shown in Figure 4-11.

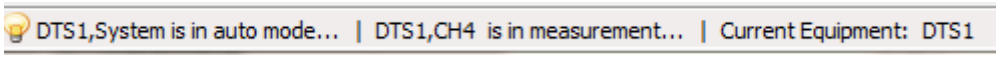


Figure 4-11 System measures the status bar

4.5 Safety panel

The Safety panel contains three indications representing the status of the communication, system, and alarm respectively. Healthy status indicators are displayed in green, warning indicators in yellow, and fire alarm or fault indications are red.

Under normal operation, the Safety panel should look like Figure 4-12.

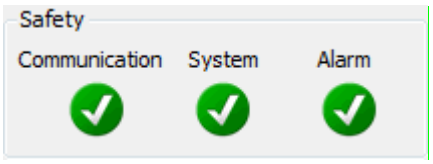


Figure 4-12 Safety panel – Healthy system

The fault indicators for each of these are shown below.

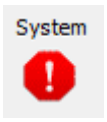
Communication:

Healthy Status *Communication with DTS is normal*

Fault Status *Communication with the DTS has been interrupted. DTSCM2 is no longer displaying live data or alarm information*

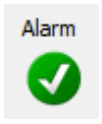
System:

Healthy Status System status is normal.

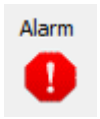


Fault Status Laser fault

Alarm:



Healthy Status *Normal temperature*



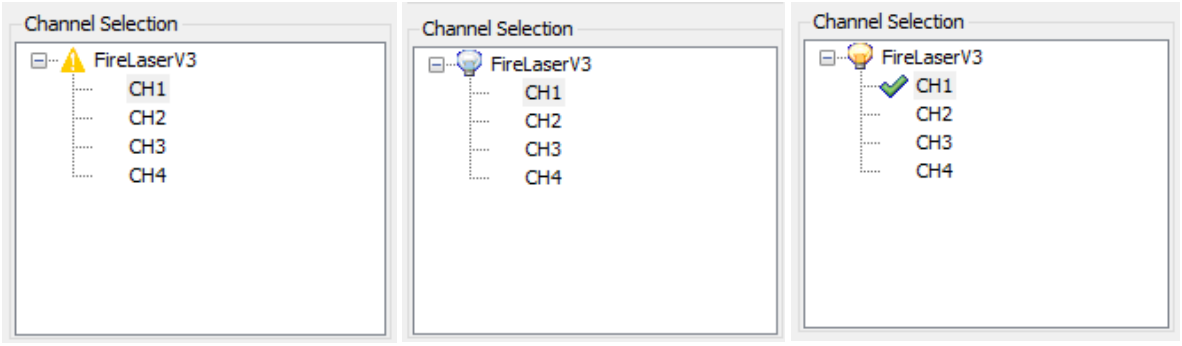
Alarm Status *One or more fire alarms raised*

4.6 Channel Selection panel

The ***Temperature & Raw Data*** graph only displays the temperature curve of the selected channel. Click to select the channel number in the ***Channel Selection*** to view the temperature data, raw data, and partition details for that channel.

The DTS name and the Channel names/quantity can be modified in the Initialize interface, see Section 6.2. The number of channels must match the actual number of channels of the corresponding DTS. The icon next to the DTS name shows the status of the DTS, and the tick mark next to the channel number shows which channel is currently in measurement.

Channel selection and status changes are as shown in Figure 4-13.



(a) *(b)* *(c)*

Figure 4-13 Channel selection panel:
(a) No communication *(b) Connected, but not measuring* *(c) Connected and measuring*

4.7 Operation panel

The ***Operation*** panel contains a single button that is used to manually Start or Stop measurement of the DTS.

When a connection is established with the DTS, the button state is synchronized with the measurement state of the DTS. Therefore, the button displays the relevant operation depending on the current measurement status of the selected DTS:

- If the DTS is currently measuring, the button will display the option to ***Stop Measurement***
- If the DTS is not in measurement, the button will display the option to ***Start Measurement***

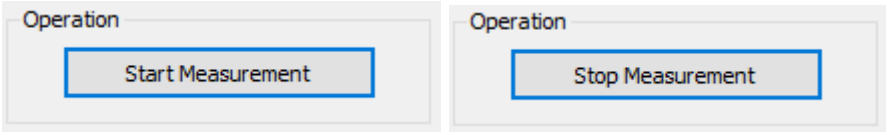


Figure 4-14 Start and Stop measurement

If DTSCM2 is connected to multiple DTSs, the user must select the corresponding DTS in the ***Channel Selection*** panel (see Figure 4-13). Click on the DTS name in the Channel Selection panel to operate the correct DTS.

For a general User, a password is required to Start and Stop the measurement. Refer to Section 6.1.

4.8 Status panel

The Status panel displays the communication status, system status, and user's operation record.

An example of the status information window is as shown in Figure 4-15.

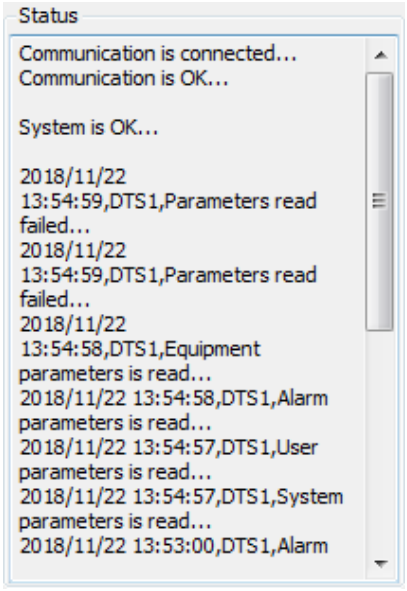


Figure 4-15 Status information window

5 Menu – File

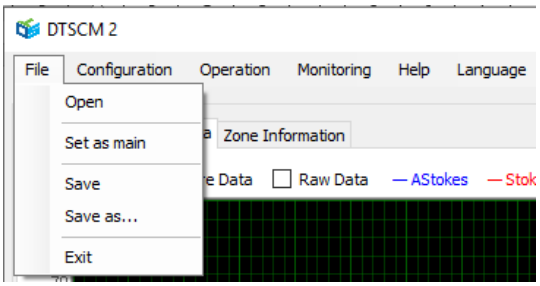


Figure 5-1 File Menu

5.1 Open

Opens an .ecp configuration file

The software saves the configuration of a project in a file with a .ecp2 extension. These saved configuration files are referred to as ECP files in this document.

An ECP file is supplied with each DTS unit purchased which contains the DTS configuration as set up by the factory. The file is named with the DTS serial number and the .ecp2 extension. A template is also provided with the DTSCM 2 software.

Before the ECP file is loaded, or the project is initialised, most of the menu items are greyed out:

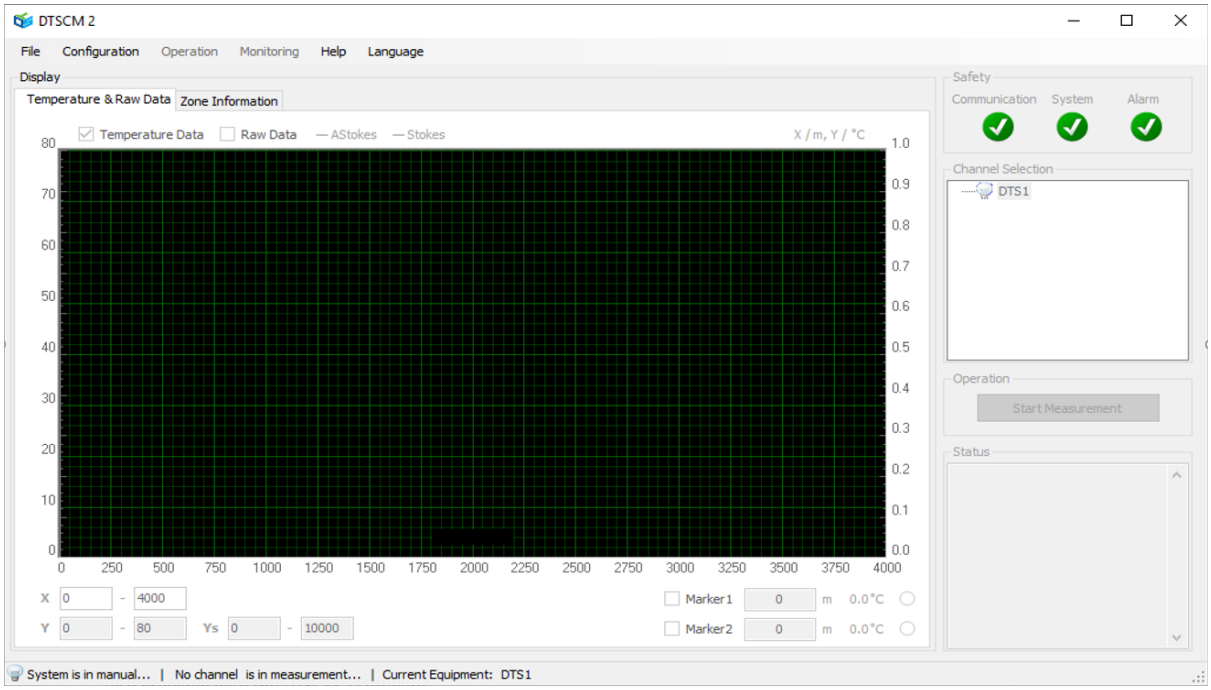


Figure 5-2 Before opening the ECP file

Selecting ***Open*** opens a file Browse Windows dialog, which defaults to the DTSCM2 software root installation directory. Select an ECP file to load the parameters.

Once this is done, the greyed-out menu items become operational.

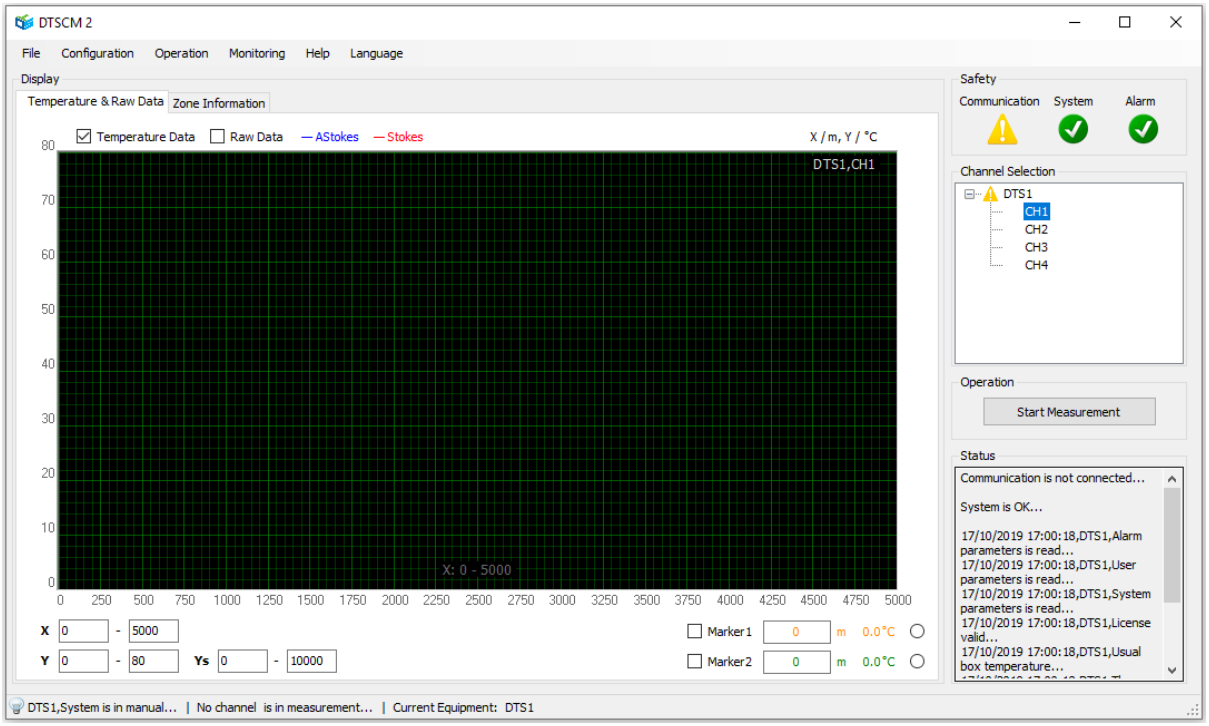


Figure 5-3 Interface with ECP file loaded

5.2 Set as main

Sets the current .ecp file as the default configuration file for the project.

If the user wants to load the same .ecp file every time that DTSCM2 is launched, select this option to set the current .ecp file as the default and overwrite the pervious .ecp file, as shown below in Figure 5-4.

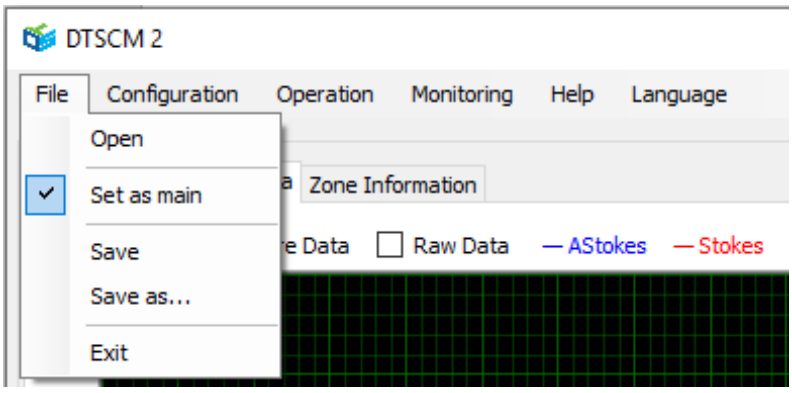


Figure 5-4 Set as main

Note: If the C: drive is selected as the default installation directory, the user may encounter permission issues like being unable to load the configuration file after launching the software.

There are two ways to resolve this issue:

1. Run the software as an administrator;
2. Find the software installation directory and change the user permissions property in the installation folder to complete control;

5.3 Save

Opens a save dialog to save the existing settings as an .ecp file.

Warning:
Be careful not to overwrite the .ecp file supplied with the DTS.
This contains the configuration for the specific DTS provided by the factory. It includes calibration settings not open for modification by the general user or administrators. It can be used to recover the correct DTS settings if unwanted changes have accidentally been made.

5.4 Save as

Saves the current configuration to a new .ecp file. This operation will not overwrite the previous .ecp file.

For example: The user can open the factory .ecp file , save it into a new .ecp file and then change the setting.

5.5 Exit

Exits the application.

The user is prompted whether to keep the current configuration on exiting the program. The user should make sure any necessary updates are saved or any unknown or undesirable changes are discarded by selecting the appropriate option. The software exiting prompt is as shown below in Figure 5-5.

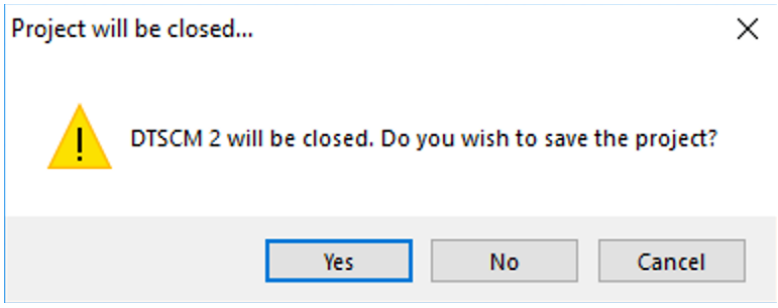


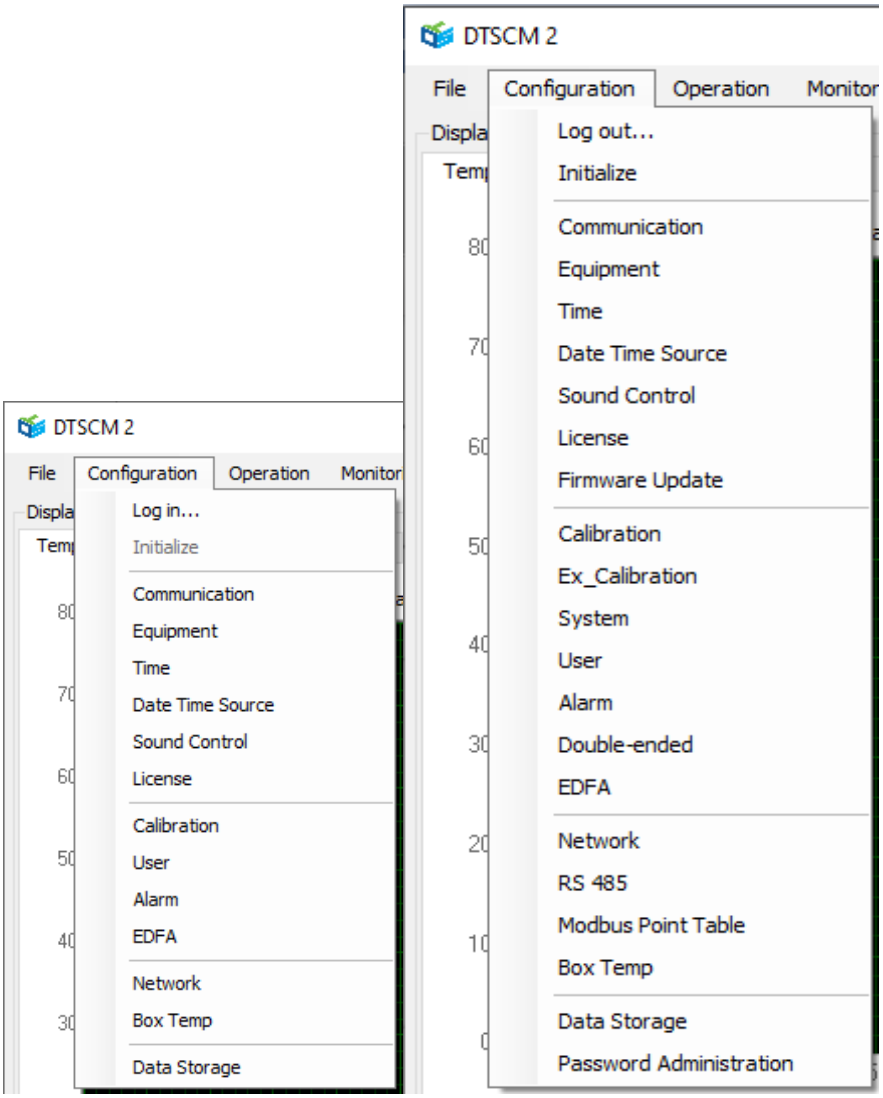
Figure 5-5 Exit prompt

Note:
Clicking the X on the top right of the software window does not shut down the DTSCM2 software, but instead sets it to run in the background. Double-click the DTSCM2 icon in Windows toolbar to restore the interface.

6 Menu – Configuration

Users can use DTSCM2 to configure the DTS, to monitor the temperature data and alarms generated by the DTS and to record DTS data.

Sub-menu under the configuration menu will present different content depending on user access rights. The Configuration sub-menu content for User level access and Designer level access is shown in Figure 6-1:



(a) User level access *(b) Designer level access*

Figure 6-1 Configuration sub-menu for User level access and Designer level access

For first time use, DTSCM2 needs to use a factory configuration file or directly read default parameters on the device. Based on these default parameters, the user must calibrate fiber and set the corresponding alarm values. It is then possible to save this as an automatic measurement. The alarm information displays in the software interface, it is then saved into a record for the user query.

Read Parameters and Update Parameters

Many menu items in the ***Configuration*** menu contact the option to ***Update*** or ***Read*** the parameters. In the case where parameter updates are required, you need to ensure that parameter synchronization is currently completed.

All parameters used by the DTS are saved internally to the DTS. Therefore, if changes to these parameters are required, the modification made in the DTSCM 2 interface must be written to the DTS by using the ***Update*** command. After the parameter update is successful, the old parameters will be overwritten.

Warning:
Incorrect parameters settings may cause the device to work abnormally.

6.1 Login

Accessed from: Configuration < Login

DTSCM2 has three different access levels. Menu items or operators that are not available to the current access level are greyed out in software interface.

6.1.1 User Level

This level of access is intended for day-to-day users of the system.

The DTSCM2 software defaults to this level when it is opened. At this level the user will use the default configuration parameters and alarm parameters to operate the system. At this level user can configure some user parameters and alarm parameters.

Start / Stop measurement

For a General User at this level, a password is required to Start or Stop measurement.

The default password is: ***123***

Figure 6-2 Password required for a General User to Start or Stop measurement

6.1.2 Designer Level

The Designer can start or stop the measurement without entering password.

In addition to User level functions, this level of access has calibration and configuration functions required for commissioning work.

The default password is: ***246810***

6.1.3 Admin Level

The Administrator log-in has access to parameters that can lead to a system failure if configured incorrectly. Therefore, this level of access requires that the specific Administrator is trained by Bandweaver.

Changes parameters only accessible to Administrators by untrained personnel will invalidate Bandweaver's warranty.

6.2 Initialize

Accessed from: Configuration < Initialize

Users may initiate a new project (available after entering edit mode). The Initialization interface is shown in Figure 6-3.

The parameters to be configured are as follows:

Equipment Selection — *Add or delete multiple DTS devices. See Section 6.3 for details, including the maximum number of DTS that can be connected.*

Channel Selection — *For the selected device, add or delete channels to match the current number of channels of the device hardware.*

Selected Channel — *For the selected device, change the device name;*
For the selected channel, change the channel name, and the default length for the display window.

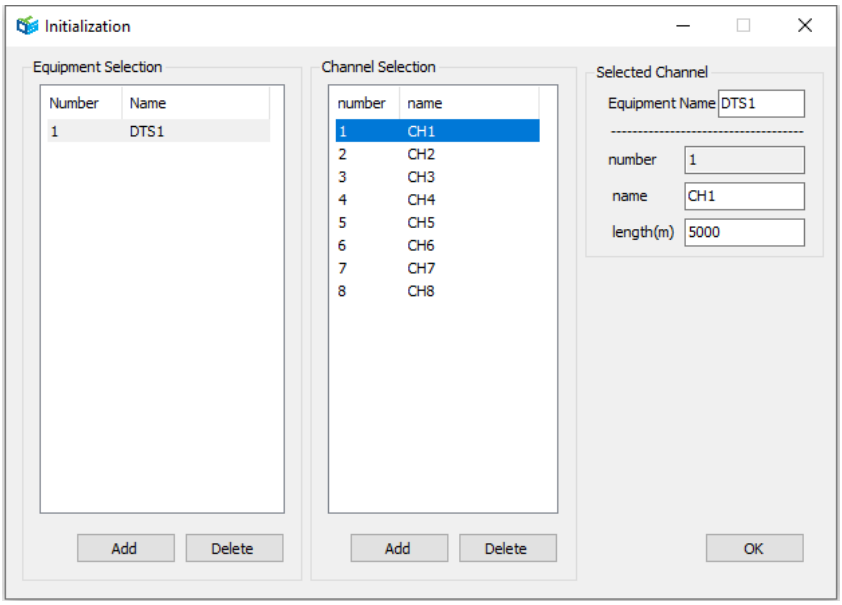


Figure 6-3 – Initialization interface: Example shows DTS1 with 8channels, length of channel 1 is 4Km

6.3 Communication

Accessed from: Configuration < Communication

The connection between DTSCM2 and the DTS currently is by network communication. The DTS provides three network interfaces: labelled RJ45-1, RJ45-2, and RJ45-3 respectively.

The DTS backplane interface is as shown in Figure 6-4.

Figure 6-4 DTS backplane interface showing location of RJ45-1, RJ45-2 and RJ45-3

Use a network cable that conforms to the EIA/TIA 568B standard to connect the PC network port to the DTS. Alternatively, the DTS may the connected to the PC or laptop running DTSCM2 via a router or hub.

Before the connection can be established, the network configuration of the PC usually must be changed to support the normal connection between DTSCM2 and DTS. Refer to Section 6.17 for the default IP addresses of the DTS ports. The user should check which DTS port is in use, and the default IP address of this port.

Set the IP address of the PC as follows:

IP address	192.168.0.xyz *where xyz is a unique value on the subnet between 1~254 (excluding 100, which is the default IP of the DTS port RJ45-1)*
Subnet mask	255.255.255.0
Default gateway	192.168.0.1

In Windows 7, the setup steps are as follows:

1. Open ***Control Panel*** → ***Network and Sharing Center*** → ***Change Adapter Settings***;
2. This will display the available connections. Right-click the network to which the DTS is connected and select ***Properties***
3. Double-click ***Internet Protocol Version 4 (TCP/IPv4)*** to open the IP address settings;
4. Select ***Use the following IP address*** and input the ***IP address***, ***Subnet mask*** and ***Default gateway*** details shows above
5. Click OK to save the changes

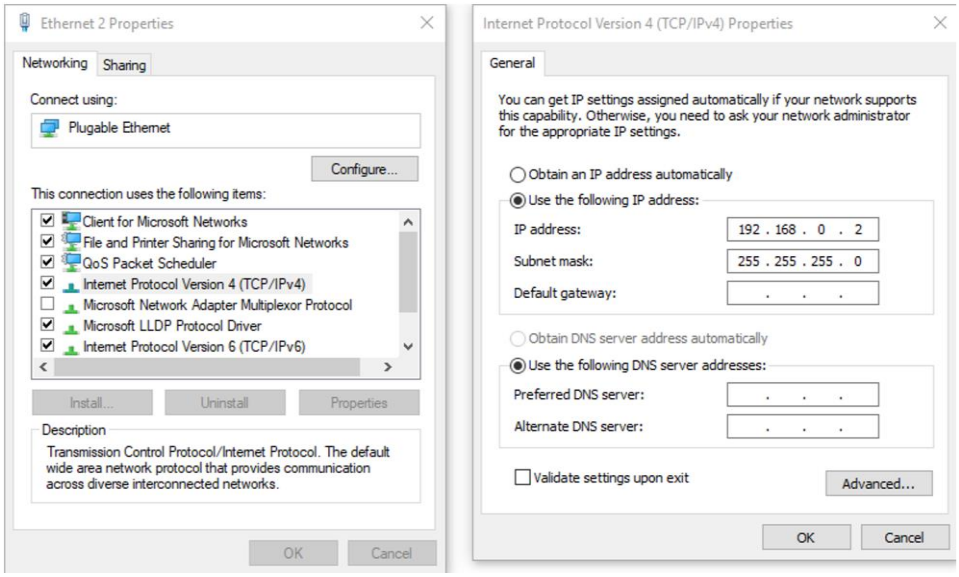


Figure 6-5 Change the IP address of the DTSCM 2 PC

After completing the IP address setting of the PC, open the Communication interface in DTSCM 2 to set the IP address and data port to which the DTS is connected.

Under UDP connection, it's not recommended to connect too many DTS. The number of allowable connections depends on the network environment and the performance of the PC. The maximum default number of units is 10.

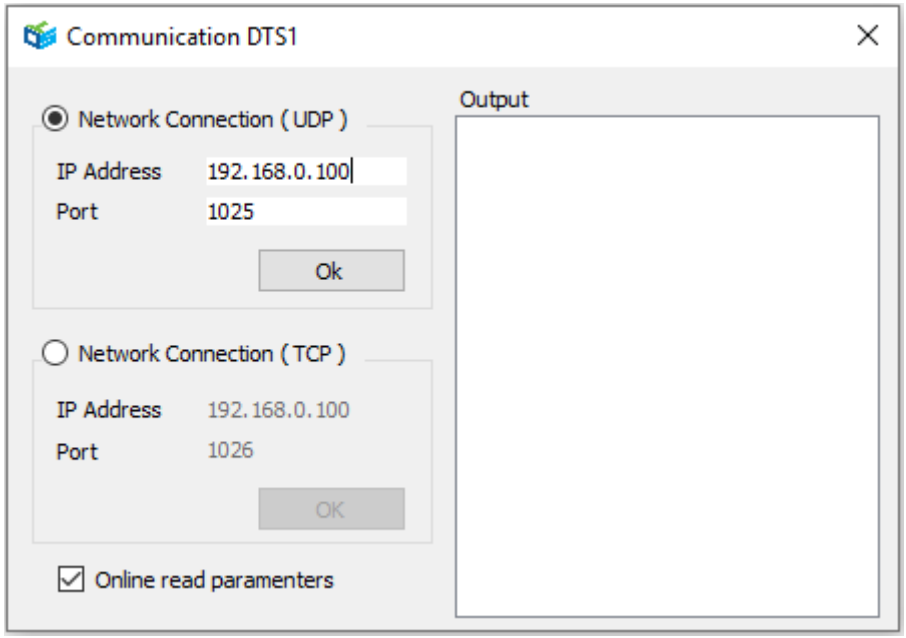


Figure 6-6 Communication configuration interface

After DTSCM2 and DTS are connected, the communication status is displayed in the Safety panel. Status comparison before and after the connection is established is shown in Figure 6-7.

Figure 6-7 Status before and after the communication connection

Online read parameters

Reads the parameters from the connected DTS.
When this box is checked, DTSCM2 will read and display the parameters saved on the DTS when the DTS is connected.
Note that this may be different to the ECP configuration file that is currently open by the user.

Warning: If the connection between DTSCM 2 and the DTS is lost, none of the data displayed in DTSCM from the disconnected device can be relied upon. Also, keep in mind that DTSCM2 is no longer displaying live data or alarm information from the disconnected DTS.

6.4 Equipment

Accessed from: Configuration < Equipment

If the selected DTS is not in measurement mode, the DTS parameters can be read, from this interface. Device parameters such as serial number, device number, and hardware version number are interrogated and displayed as shown in Figure 6-8.

The device info is a configurable parameter which is set to coincide with the factory Serial Number of the DTS.

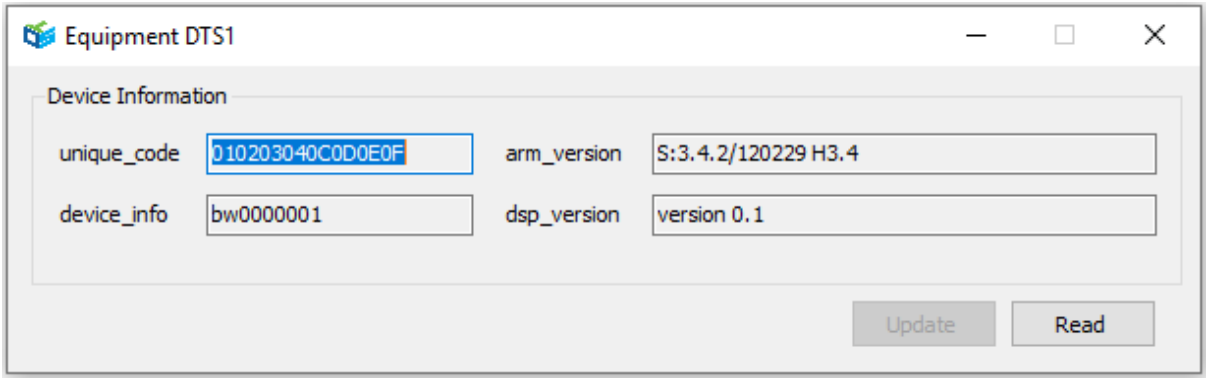


Figure 6-8 Device parameter interface

6.5 Time

Accessed from: Configuration < Time

The interface can be used to set up the DTS running clock. The time displayed in the interface defaults to be the PC clock time when opened. To view the DTS time, click on the "Read" button to update the window time.

The DTS default pre-set time is GMT, and the accuracy is ⩽ 2 ppm. Generally, it does not need adjustments. However, the time may be adjusted by a Designer or higher level of access.

The ***Time*** interface is as shown in Figure 6-9.

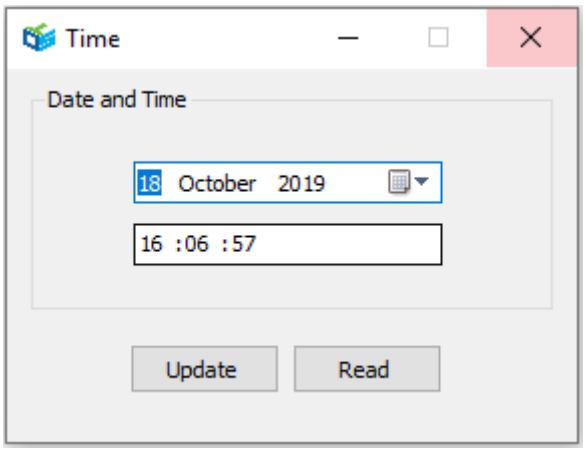


Figure 6-9 Time interface

Input the correct time and click ***Update*** to save the changes. Restart the DTS after modifying the Date or Time.

6.6 Date Time Source

Accessed from: Configuration < Date Time Source

The ***Data Time Source*** interface allows DTSCM 2 to display alarm information, documentation and other time related functions using a different time source. When this option is enabled, the display of above information will be based on the DTS clock, and this will be used to update the current time of the PC. Otherwise, the time refers to the PC clock.

If the local time and the DTS time must be consistent with the actual time, use the Time function (see Section 6.5) to update the DTS time. The Date Time Source interface is as shown in Figure 6-10.

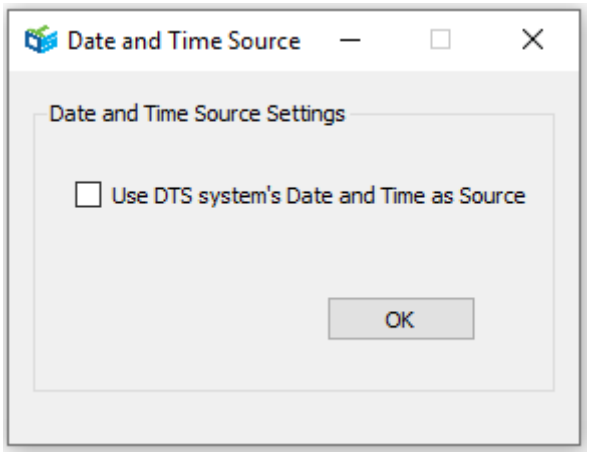


Figure 6-10 Time source

6.7 Sound Control

Accessed from: Configuration < Sound Control

Sound control allows DTSCM2 to trigger audible outputs when receiving temperature data, fault and alarms. The Sound Control interface is shown in Figure 6-11, and relies on the PC hardware for correct operation. It is a way for user to receive audible notifications from the IPC when an event of interest has occurred.

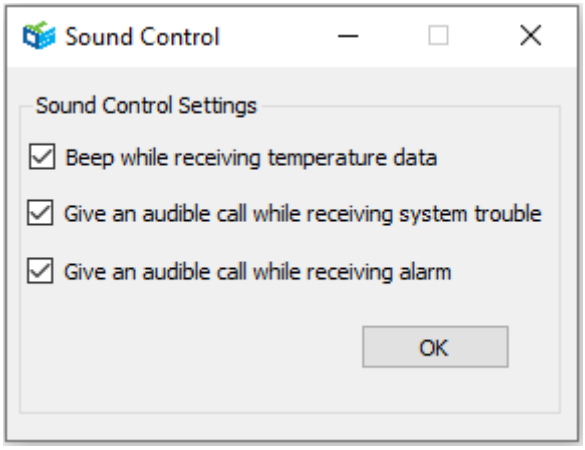


Figure 6-11 Sound control

6.8 Authorization

Accessed from: Configuration < Authorization

These are Bandweaver Factory and R&D settings not available to any external users.

6.9 Firmware Update

Accessed from: Configuration < Firmware Update

These are Bandweaver only settings not available to any external users.

6.10 Calibration

Accessed from: Configuration < Calibration

Calibration of the DTS system is completed in advance at the factory.

However, in many cases, especially for non-Fire applications where a variety of sensing fiber optic cables may be used, some parameters may need recalibration. This calibration function provides users with the possibility of calibrating the DTS for different cable types.

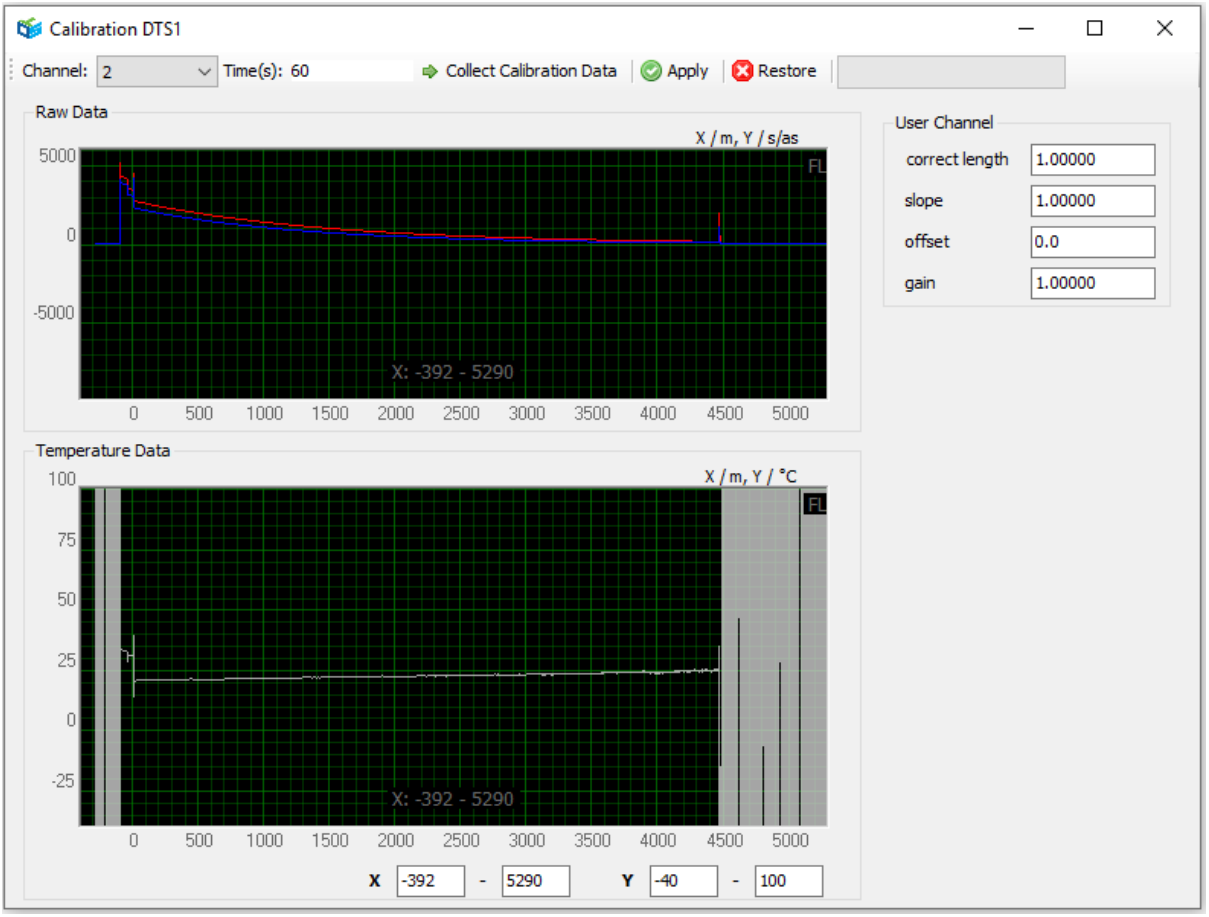


Figure 6-12 Calibration interface

The following fields and functional regions are available:

Channel — *Select the channel that needs calibration from the drop-down. Each channel is calibrated independently of the rest.*

Time (s) — *Data acquisition time during calibration. The longer the collection time, the more accurate the results of the calibration.*
The recommended calibration time range is 30s ~ 240s.

Raw Data *The raw data graph displays the obtained pattern after the acquisition is complete.*

Temperature Data *After the acquisition is complete, and the raw data is normal, the graph shows the calculated temperature data.*

User Channel:

Adjusting these parameters will change the DTS calibration. This can be done by following the calibration process described in the sections below. Once these values are updated, the calibration parameter adjustment is completed, but not yet in force (see point 5. of the calibration procedure below).

Correct Length *Calibration parameter – refer to Section 6.10.1*
To set the true length of the sensing fiber.

Slope *Calibration parameter – refer to Section 6.10.2*
To remove the effects of external factors on the slope of the temperature trace – for example, a different sensing cable compared to that used in the factory calibration.

Offset *Calibration parameter – refer to Section 6.10.3*
To remove the difference between the temperature measured by the DTS and the true absolute temperature.

Gain *Gain coefficient of the temperature. Do not change. Keep the default value.*

Restore *Discards the parameters generated after the adjustment, and restores the values to before the parameter settings.*

Apply *Writes the calibration parameters to DTS.*
Note: caution, back up ECP file before updating.

Calibration Procedure:

1. Select the channel to be calibrated from the drop-down list;
2. Set the data acquisition time according to the cable length – recommended 30s ~ 240s;
3. After selecting a channel and time settings, click the ***Collect Calibration Data*** button to start data acquisition. The raw data graph displays the obtained pattern after the acquisition is complete.
   After the acquisition is complete, and the raw data is normal, the graph shows the calculated temperature data
4. Following the procedures in sections 6.10.1, 6.10.2 and 6.10.3 to determine the parameter values;
5. The user can decide how to proceed:
   a. If the user is not satisfied with the calibration parameter changes, click ***Restore*** to abort the current parameter after adjustment, and return to the original parameters.

b. If the user is satisfied with the calibration parameter changes, first make a back-up of the current .ECP file. Without this, the previous settings cannot be recovered. Click ***Apply*** to save the settings. The user will be prompted again to confirm the overwrite:

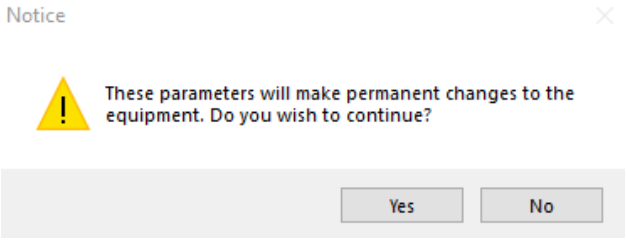


Figure 6-13 Calibration parameter update prompt

Click ***Yes*** to confirm the changes, or ***No*** to cancel.

6.10.1 Length Calibration

The DTS is suitable for most multimode fiber, but for better spatial resolution, fine length calibration is possible. The two raw data curves – stokes and anti-stokes – of the fiber are used as a reference, and the calibration values are adjusted so that the ends of the two curves are in the same position.

The Raman scattered light signal required for DTS temperature measurement includes two wavelengths, which are called Stokes light and anti-Stokes light, respectively. The refractive index of these different wavelengths of light will be transmitted in the same medium. As such, the speed at which the Stokes light and the anti-Stokes light travel in the fiber will be different which causes a slight deviation in the actual position of the Stokes and anti-Stokes signals in the fiber. However, the length of the fiber is constant.

The aim of the DTS length calibration to eliminate this small deviation and adjust the Stokes and anti-Stokes at one chosen point to the same point in the fiber. This is done by fine-tuning the length calibration parameters.

In the raw data window, click drag the mouse to select the curve near the end of the fiber. This will zoom into the selected area. Zoom-in as required to clearly see the Stokes and anti-Stokes positions at the fiber tail.

Most of the fiber tail signals are reflected, but in rare cases, no reflected signals are generated. An example of a non-reflected signal is as shown in Figure 6-14. Adjust the ***correct length*** field to align the tail end of the Stokes and anti-Stoke signals.

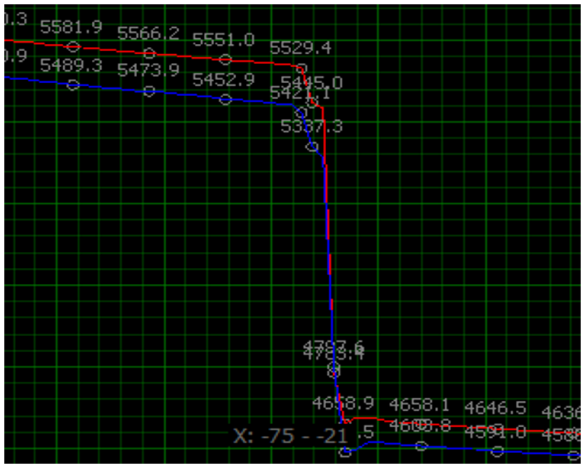


Figure 6-14 Fiber end point of a non-reflective sample

For cases where there is a reflection at the end of the fiber, an example of which is shown in Figure 6-15, the shape and amplitude of the reflected signals will be different.

The most common of these is where the fiber end point signal will first rise and then fall to form a typical reflection peak. When the signal changes abruptly, the signal transition may contain multiple data points, which is not conducive to calibration analysis. Therefore, we select the first reflection peak at the end of the fiber and adjust the length calibration parameters so that the centre of both, Stokes and Anti-Stokes, peaks are aligned at the same point. The waveform comparison before and after calibration is as shown in Figure 6-15.

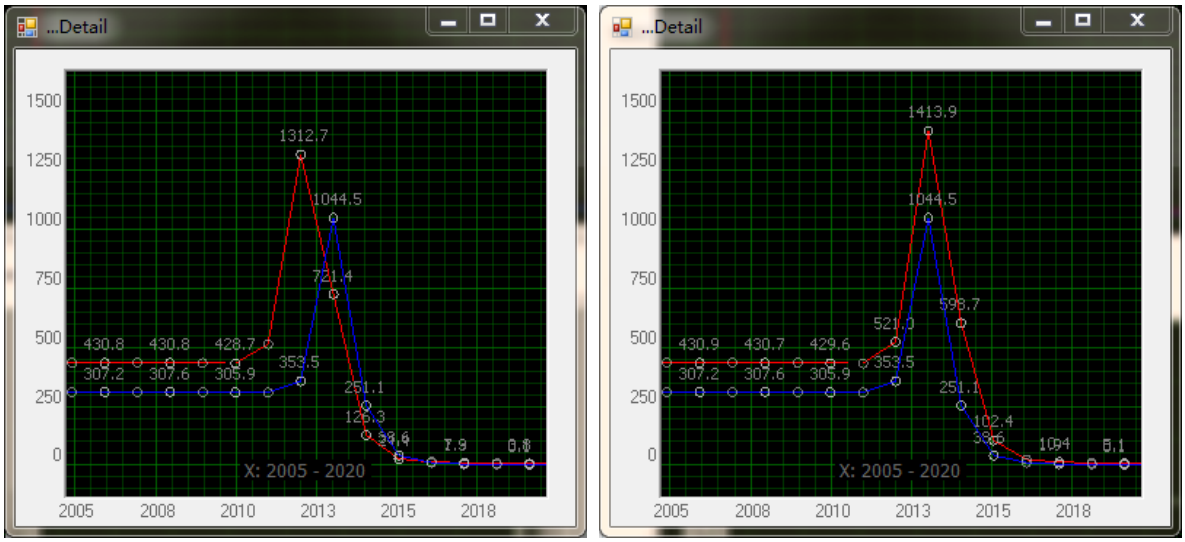


Figure 6-15 Compare the length of the original signal before and after calibration

6.10.2 Temperature Slope Calibration

The purpose of temperature slope calibration is to ensure accurate temperature measurement of distributed data over the entire sensing cable. The equipment is factory-calibrated using conventional fiber optics. However, there may be small differences in the loss between Stokes and anti-Stokes in

different types of fiber optic cables, which may cause the temperature slope to change after the DTS is connected to a new sensing cable.

As the installed fiber for the application will most likely be different to that used for the factory calibration, the commissioning engineer should connect the fiber optic cable to the DTS for temperature slope calibration after the sensing fiber is installed. Each channel in use will need to be calibrated separately, with the fiber that will be connected to it in normal use.

If the probe cable is installed in an area where the temperature is constant, the commissioning engineer can directly observe the slope of the temperature curve of this segment to determine if the sensing cable must be calibrated for slope. In this case, when adjusting the slope, simply set the slope value so that the temperature curve is flat along the length of the sensing cable.

If the sensing cable is installed in an area with varying temperatures, actual temperature values (measured using a calibrated temperature probe) of two distant points is required on the cable. These two points must be more than 10 meters apart.

If the temperature measured by the DTS at the first point matches the actual temperature value at that point, then, the User can proceed with the Temperature Slope Calibration to adjust the slope, so that the measured temperature and the actual temperature at the second point match. If the DTS measured temperature at the first point does not match with the actual temperature value at that point, then, please refer to Section 6.10.3 to do the Temperature Offset Calibration first. After completing the Temperature Offset Calibration, the User can proceed with the Temperature Slope Calibration. To do this, adjust the slope value so that the measured temperature and the actual temperature at the second point match.

6.10.3 Temperature Offset Calibration

Temperature offset calibration is also used to obtain a more accurate temperature measurement. The temperature offset calibration allows the user to calibrate the temperature measured by the DTS to the real temperature using a calibrated temperature probe.

Before the temperature offset calibration, first, prepare a calibrated temperature probe, and then select a sensing cable with a length of at least 10 meters as the reference point.

- If a slope calibration has already been completed, or is not required – see Section 6.10.2 – a reference point can be selected anywhere on the cable. Set the offset value so that the temperature measured by the DTS is the same as that measured by the calibrated temperature probe.

- If a slope calibration is required but has not been completed, it is best if this is completed first. However, if this is not possible, or the offset is required to be determined in advance, the error of the slope versus temperature offset calibration must first be eliminated. This is done by selecting a cable close to the DTS fiber outlet as a reference. The ambient temperature of the cable is measured by a calibrated temperature probe, and then the measured temperature of the cable is adjusted to match the actual temperature value.

6.11 System

Accessed from: Configuration < System

There is a high level of interdependence between the various parameters in the System settings, and unreasonable or incorrect settings can cause a system failure.

For this reason, most of these settings are greyed out and not available to users. The interface is shown in Figure 6-16.

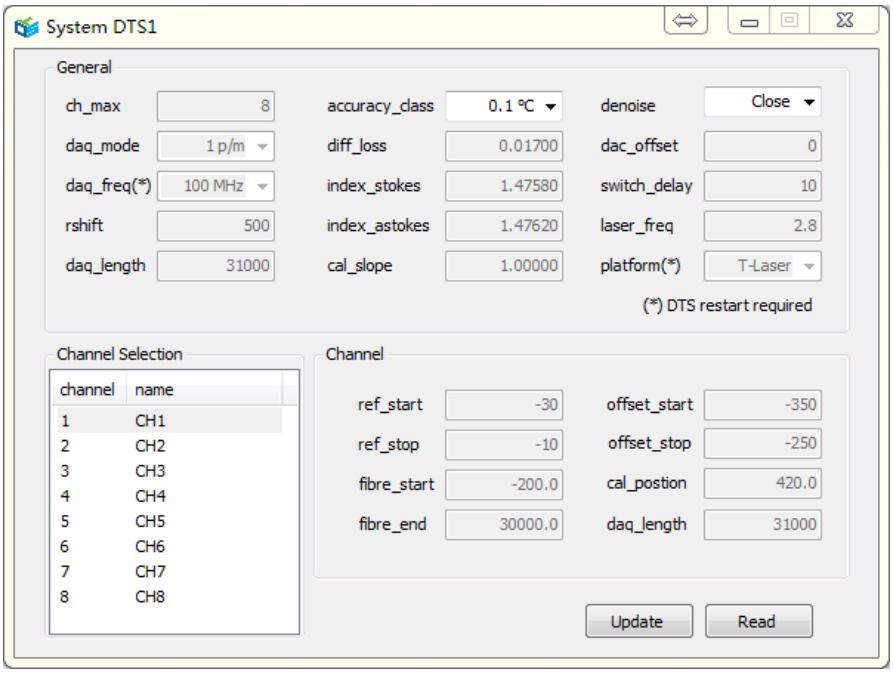


Figure 6-16 System parameters

As can be seen from Figure 6-16, two of these parameters are available to the user:

Accuracy class *Accuracy rating of displayed temperature:*
0.1℃ accurate to 0.1℃
0.01℃ accurate to 0.01℃.

Denoise *This function is able to improve the temperature resolution by up to double.*
During continuous measurement, it measures about 20 cycles to take effect.
Noise reduction options:
Close Disable
Open Enable

6.12 User

Accessed from: Configuration < User

Use this interface to set user configurable settings, such as the total measurement period, the average length, each channel measurement time and the channel name.

Designers can configure the calibration parameters for each channel. General users can only adjust the calibration parameters from within the calibration interface.

The User interface is shown in Figure 6-17.

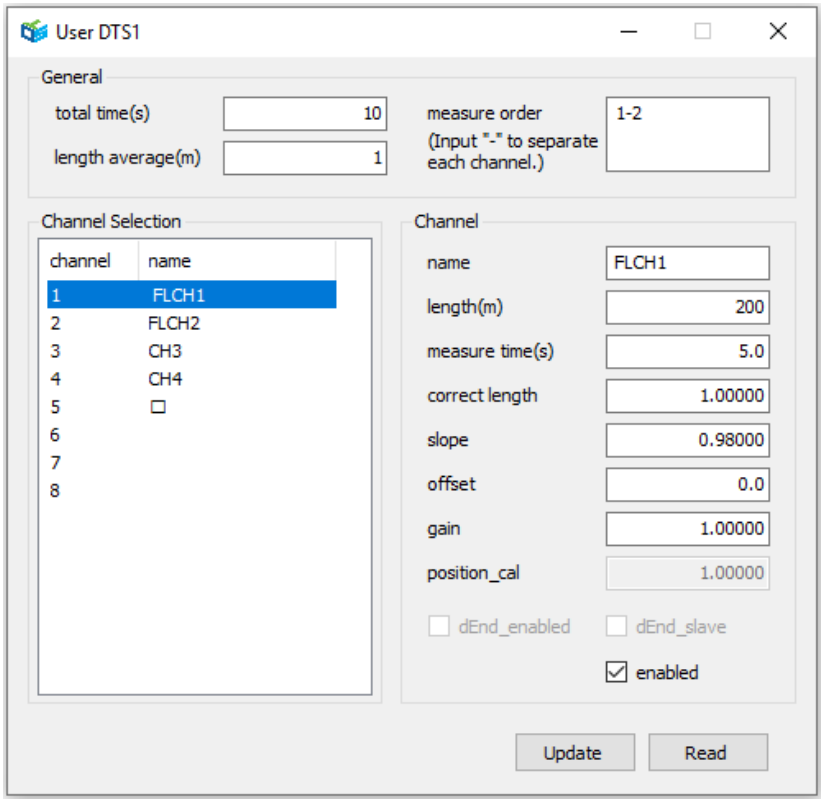


Figure 6-17 User parameters

General parameters:

total time (s) *Sum of time measurement time of each channel. The sum may be equal to or larger than the total measured time; in this case the difference is the waiting time.*
For example, for a 4-channel system, where each channel is measuring for 10 seconds, the total time must be set to 40 seconds or more. If it is set to 50 seconds, the remaining 10 seconds is rest time for the laser. This can help extend the laser lifetime.

length average (m) *The measured temperature data is averaged over this length. This can be used to smooth noisy temperature curves in applications with less demanding spatial resolution requirements*
Valid value range is 1-8m.

measure order *Sets the channel measurement sequence for each measurement cycle. Only the channels in the sequence are measured, and the rest are automatically skipped.*

Channel Selection *A list of channel numbers and the corresponding names are displayed in this panel. Click the channel of interest from the list to display its parameters in the corresponding fields on the right (see **Channel** below).*

Channel:

Name *Channel name.*
Characters in length 20. The default is CHx, x = 1, 2, 3....

Length *Channel length as configured within DTSCM2.*

Measure time *Data acquisition time of the selected channel*
In practical applications, the measurement time of each optical channel must be set according to the length of the measurement cable and the requirements of the end user.

Correct length *Calibration parameter – refer to Section 6.10.*
Original data contains Stokes and anti-Stokes raw data. Calibration parameters make the length of the two signal points aligned at the tail end of the fibre, thus providing better spatial resolution.

Slope *Calibration parameter – refer to Section 6.10.*
Slope of temperature adjustment.

Offset *Calibration parameter – refer to Section 6.10.*
Adjust the temperature offset.

Gain *Calibration parameter – refer to Section 6.10.*
Gain coefficient of the temperature. Do not change. Keep the default value.

Enabled *Enables or disables the channel. Only enabled channels participate in measurement.*

Update, Read *Update new parameters to DTS or read current parameters from DTS. Modified parameters become effective only after the update to DTS is complete.*

6.13 Alarm

Accessed from: Configuration < Alarm

Use this interface to set alarms of fibre break alarm, alarm thresholds, alarm zoning, and other related functions.

In practical applications, it is necessary to divide the zones according to the layout of the optical cable and set the relevant alarm thresholds according to the application requirements. The relevant alarm parameters must be set reasonably to trigger the event.

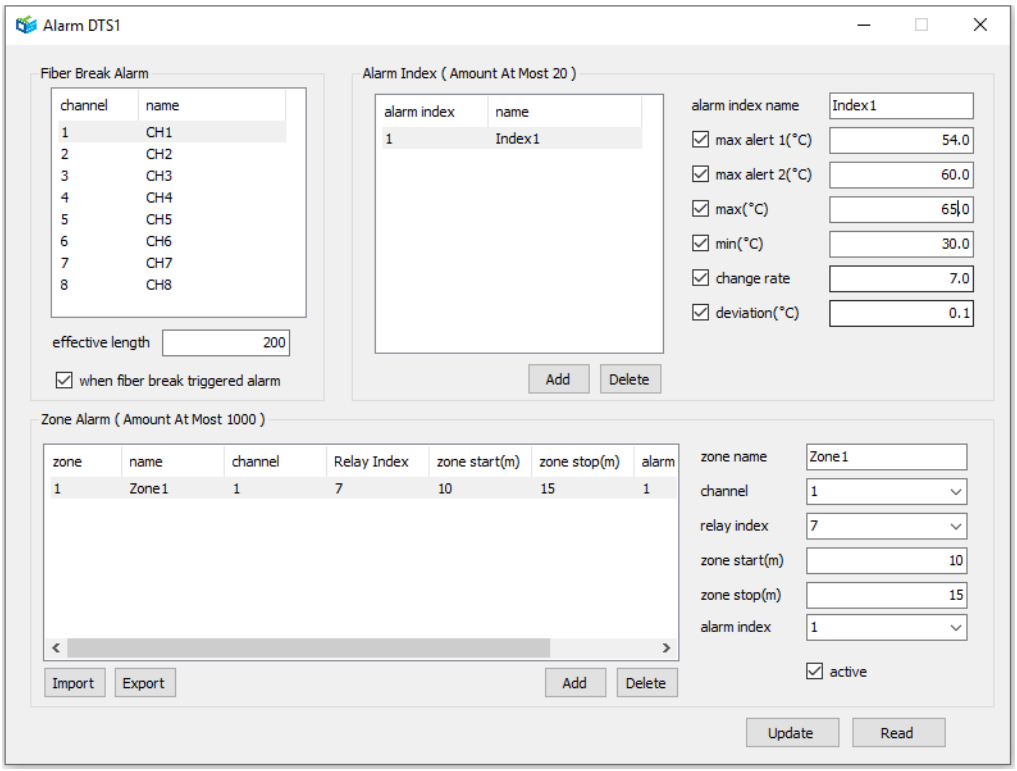


Figure 6-18 Alarm parameters

As shown in Figure 6-18, this interface is divided into 4 main areas:

1. fibre break alarm,
2. alarm index,
3. alarm zones,
4. Update/Read operation buttons

Each of these is described in the following sections.

6.13.1 Alarm – Fibre Break Alarm

In fibre break alarm, each channel includes two parameters settings: The effective length of optical fibre and alarm trigger when fibre breaks.

Effective length *Set the effective length of the fibre. Keep in mind that a fiber break beyond this effective cable length will not trigger an alarm.*

when fibre break triggered alarm *Enables or disables the fiber break alarm for the selected channel.*

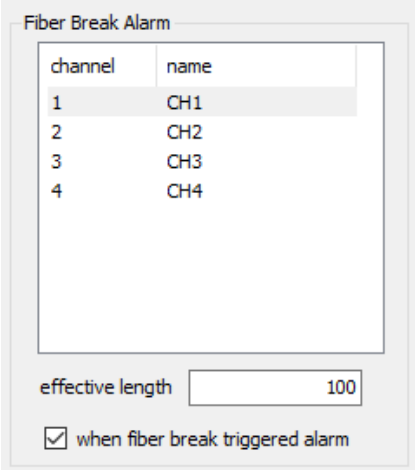


Figure 6-19 Alarm - FIber Break alarm

When the fibre break event happens, the DTS will produce visible and audible alarms while DTSCM2 will automatically pop up the alarm interface to display the alarm contents.

6.13.2 Alarm – Alarm Index

An alarm index can be used to store a standard or a set of preconfigured alarm threshold information. These may be used to reduce the complexity of alarm configurations for a project or on a site. When different zones use different alarm thresholds, the user can directly retrieve saved alarm configurations by referring to the alarm index.

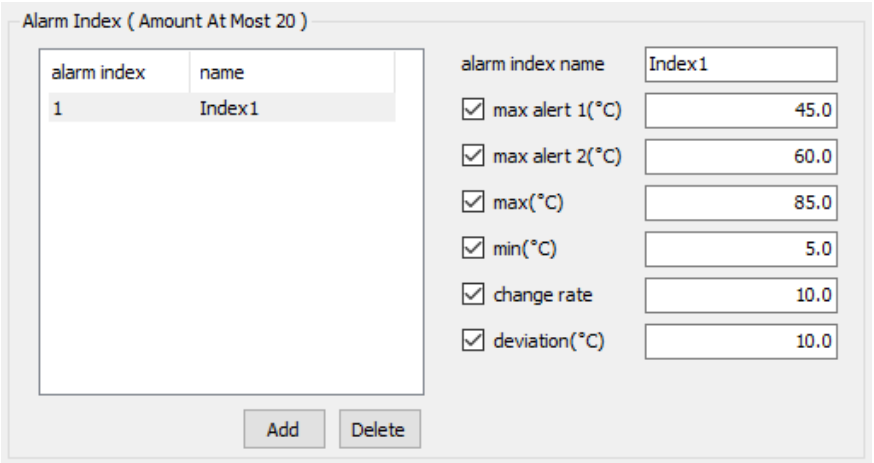


Figure 6-20 Alarm - Alarm Index

At least alarm index data must be configured with the relevant thresholds, and up to 20 alarm index configurations may be stored.

Max alert 1 (°C) *Primary temperature alarm threshold*

Max alert 2 (°C) *Secondary temperature alarm threshold*

Max (°C) *High-temperature alarm threshold*

Min (°C) L*ow-temperature alarm threshold*

Change rate *Rate of rise alarm threshold. Please see notes below to understand the working of the change rate algorithm.*

Deviation (°C) *Threshold of peak temperature against the zone average – temperature spike.*

Notes:

[1] The change rate algorithm starts after 20 measurement cycles are complete. After that, the change rate value in the zone information section updates for every measurement cycle.

[2] Each measurement point in a zone has a change rate value, this value is calculated by referring to the temperature values of the previous 20 measurement cycles at that point. The real-time change rate value displayed in the zone information section is the maximum change rate among all the points in that zone.

[3] The unit of the change rate value displayed in DTSCM2 is a function of the measurement cycle. If the measurement cycle time is 20 seconds, then the unit of change rate will be ° C/ (20 seconds x 20 previous measurement cycles) i.e. ° C/ 400 seconds.

[4] The change rate threshold is meant to trigger an alarm more quickly as compared to the maximum temperature alarm threshold. This is the main function of the change rate setting.

[5] The change rate threshold is to be set much lower than the actual temperature changing rate of the environment. This is to compensate for the slower response time of the fiber.

[6] We should check the peak-to-peak noise of the zone while setting the change rate threshold. The peak-to-peak noise in the image below is about 0.8 ° C. So, we should set the change rate threshold higher than three times the peak-to-peak noise i.e. higher than 2.4 ° C (3 x 0.8° C).

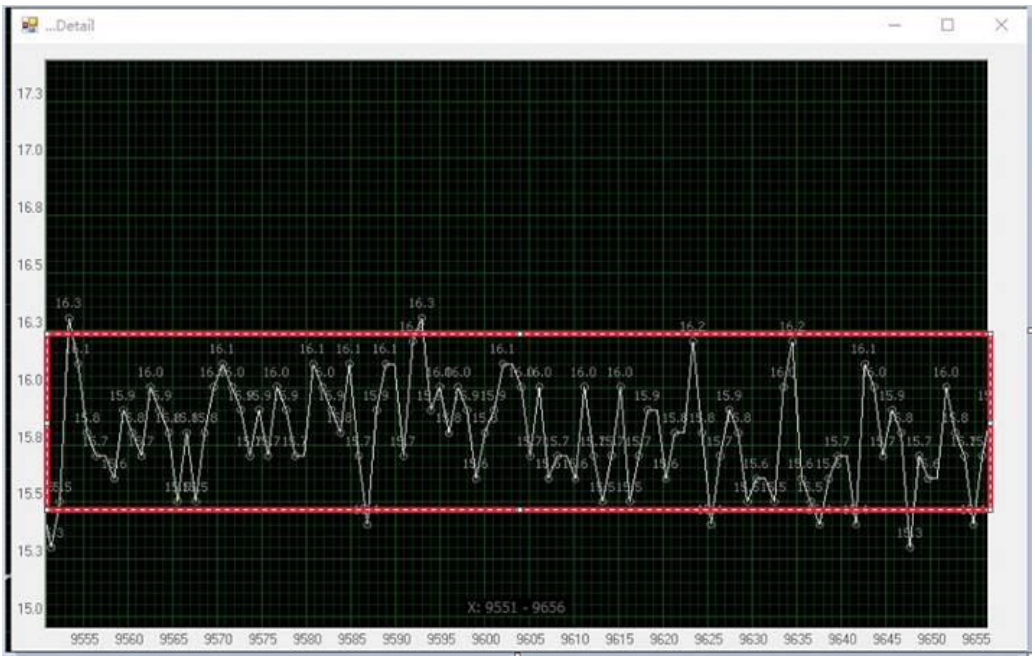


Figure 6-21 Peak-to-peak noise to set change rate threshold

6.13.3 Alarm – Zone Alarm:

Set up the temperature alarm zones and set the properties for each zone. The maximum number of zones is 1000.

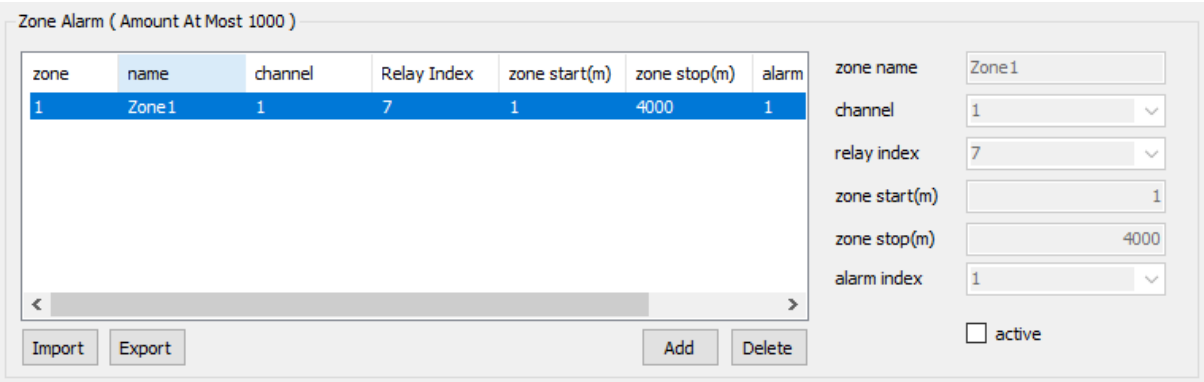


Figure 6-22 Alarm - Zone alarm

Zone Name *The zone can be given a name that is useful to the system user*

Channel *The selected zone is assigned to the specified channel.*

Relay index *Assigns the relay that will be activated when a temperature alarm is triggered in the selected zone.*

Zone start (m) ***T**he start position of the selected zone in meters.*

Zone stop (m) ***T**he end position of the selected zone in meters.*

Alarm Index *The alarm index in use for the selected zone (See Section 6.13.2).*

Active *Activates or deactivates the selected zone. Only active zones upload real-time information and trigger alarms.*

Add, Delete *Add or delete a zone.*

Import, Export *Import an existing zone configuration or export the current zone configuration.*

When an alarm occurs in an active zone, the DTS will produce visible and audible alarms while DTSCM2 will automatically pop up the alarm interface to display the alarm contents.

6.13.4 Alarm – Update, Read

Update parameters to DTS or read parameters from DTS.

6.14 Double-ended Configuration

Accessed from: Configuration < Double-ended

Before beginning with the double-ended configuration, connect one end of the fiber to one channel and the other end of the same fiber core to the other channel.

In the double-ended window, you can add or delete multiple double-ended loops. Also, you can set name, measure channel, paired channel, length (m), and offset.

Please follow the steps shown below to do the double-ended loop configuration:

1. Click on the **Add** button to add a double-ended loop.

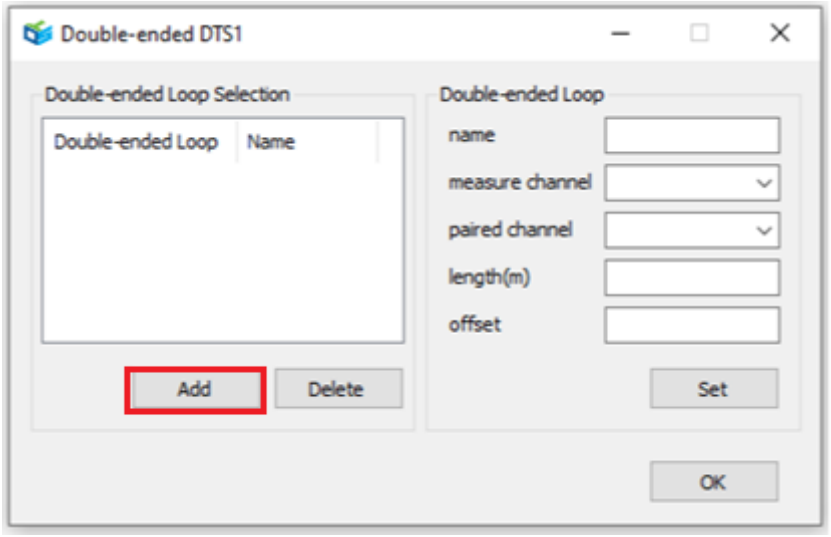


Figure 6-23 Add/ Delete Double-ended loop

2. Enter the name, measure channel, paired channel, and length(m) as per your setup. Then, click on the **Set** button to open the Double-ended settings window.

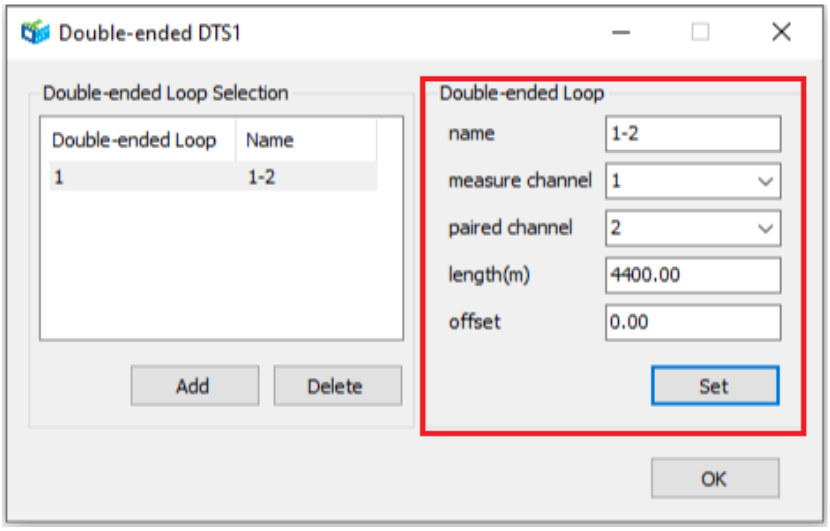


Figure 6-24 Double-ended loop setup parameters

3. In the Double-ended settings window, adjust the double-ended parameters. Click on the **Collect Raw Data** button to collect raw data and to show the trace of the measure and paired channel. Change the **Net Loop Length(m)** to align the trace of the two raw data's zero point and fibre endpoint. If the temperature trace is too high or too low, change the Offset to adjust it. If all settings are ok, click on the **Ok** button to close the window.

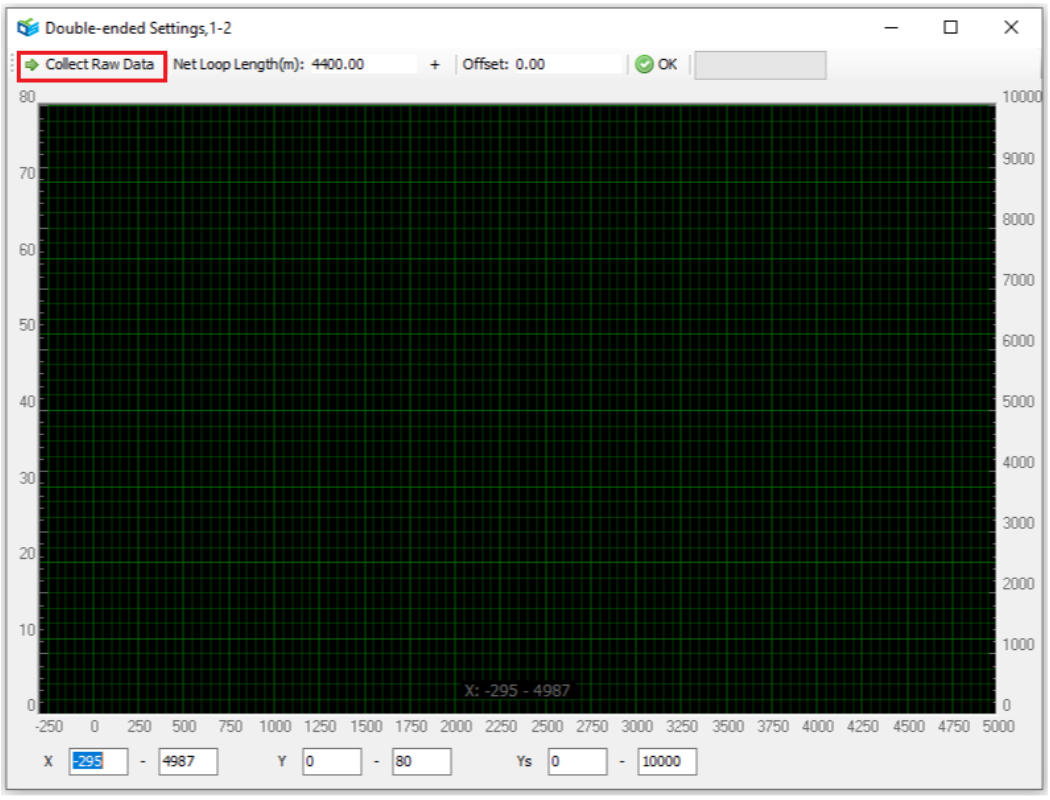


Figure 6-25 Double-ended settings window – Collect raw data

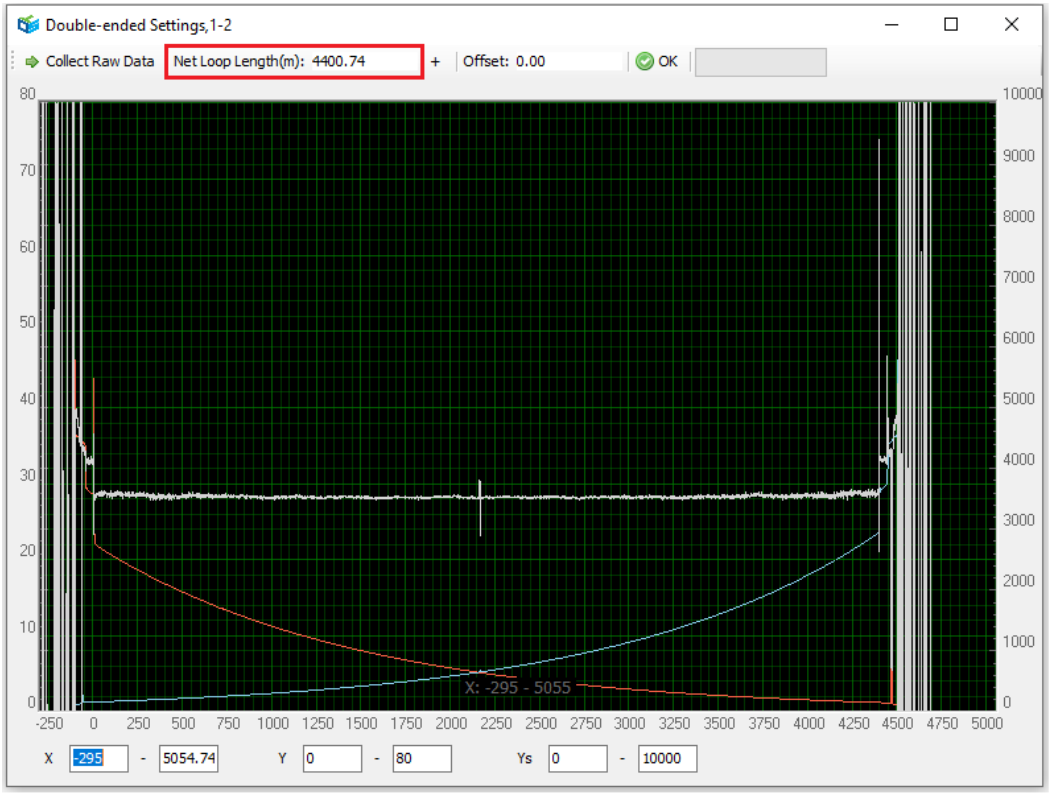


Figure 6-26 Double-ended settings window - Net loop length(m)

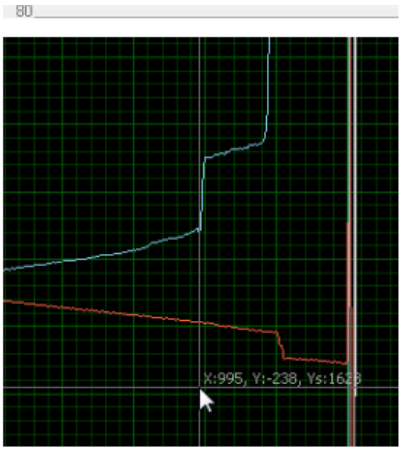


Figure 6-27 Before net loop length setup

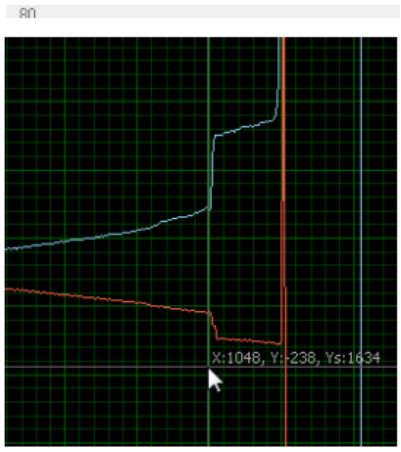


Figure 6-28 After net loop length setup

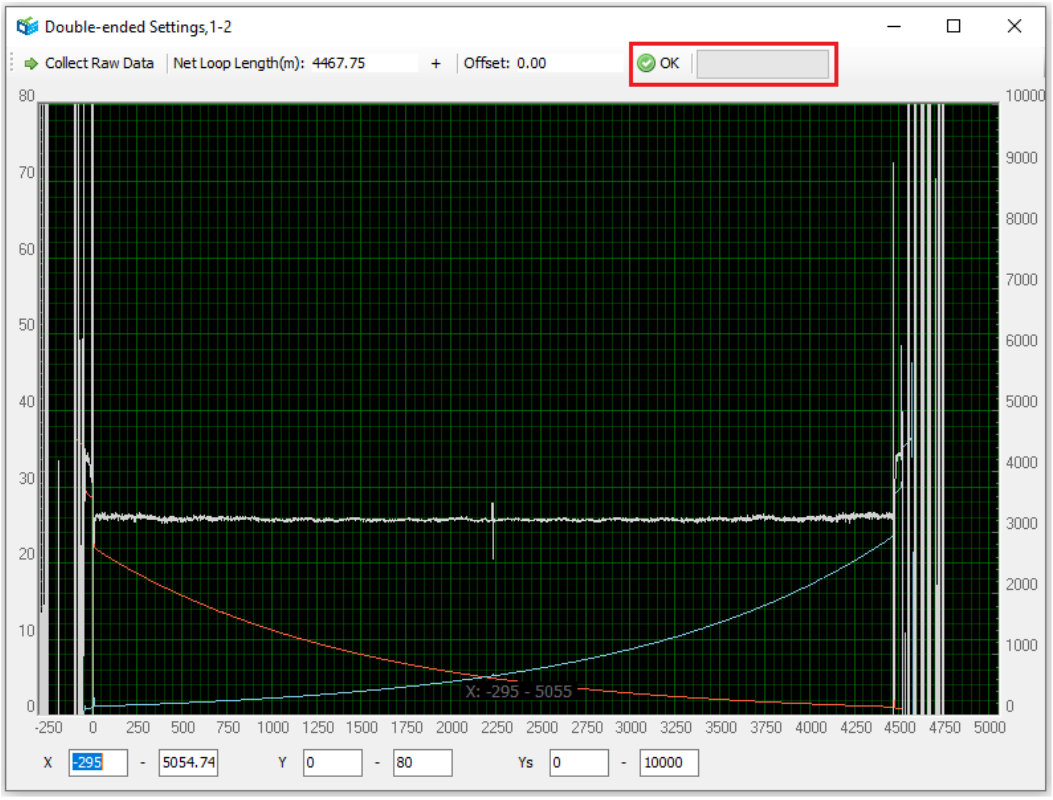
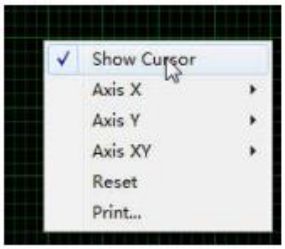
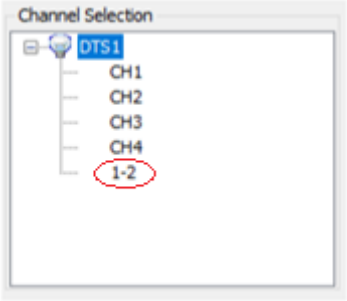


Figure 6-29 Double-ended settings window - Ok

Note:
The **Net Loop Length(m)** generally is the real fiber length. The **Offset** is generally zero.
On the chart right-click, then select the **Show Cursor** to show the cursor.



4. If all the double-ended loops are set then, click the **Ok** button from Figure 2-1Figure 6-24. Then the double-ended loop will show in the **Channel Selection** section as shown below:



Note: There might be a vertical peak displayed at the center of the temperature plot, try to reduce this by adjusting the Net Loop Length(m), if it is too high.

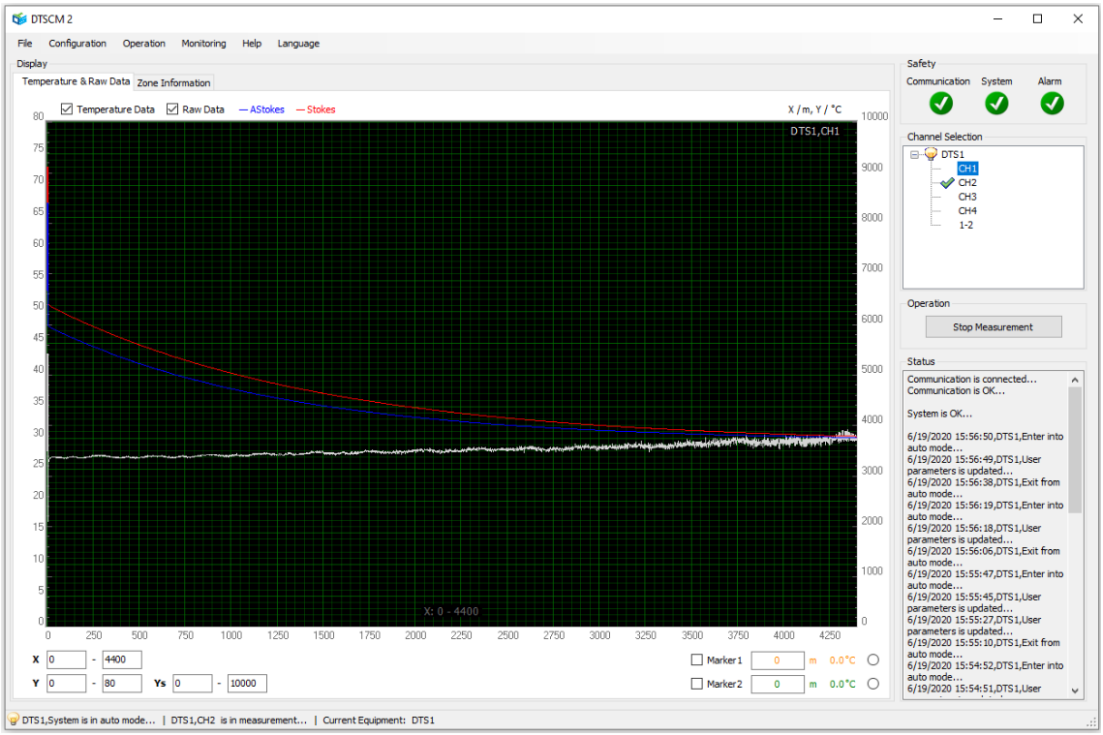


Figure 6-30 Channel 1 measurement (measure channel)

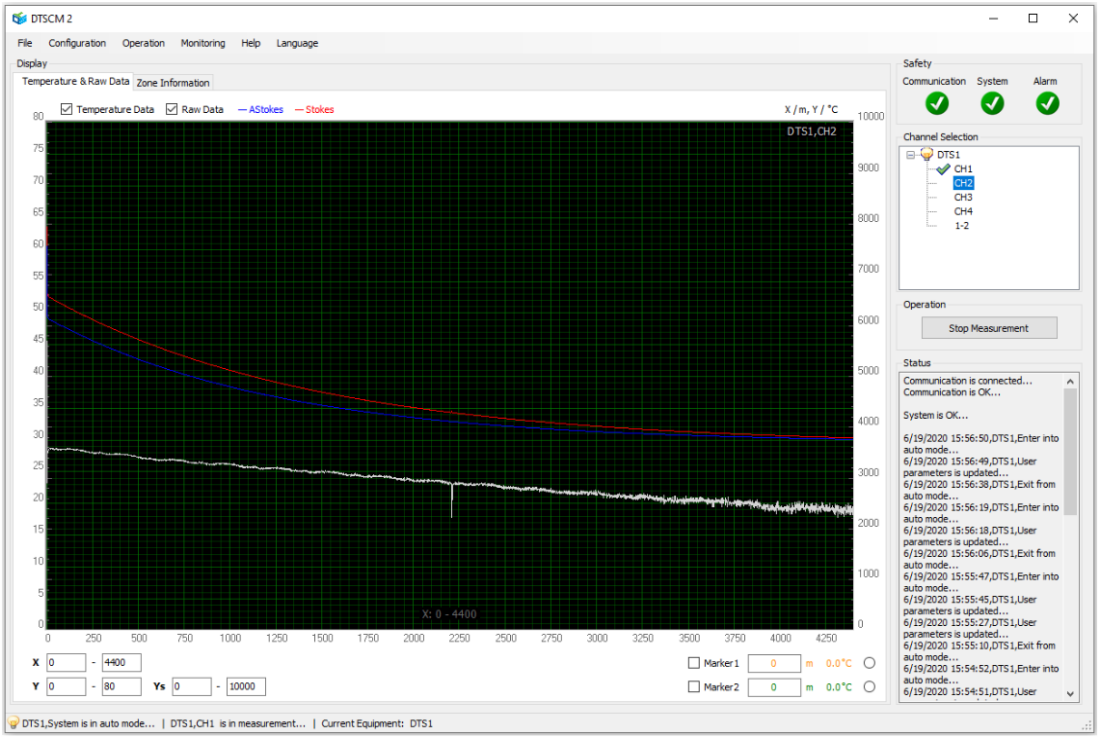


Figure 6-31 Channel 2 measurement (paired channel)

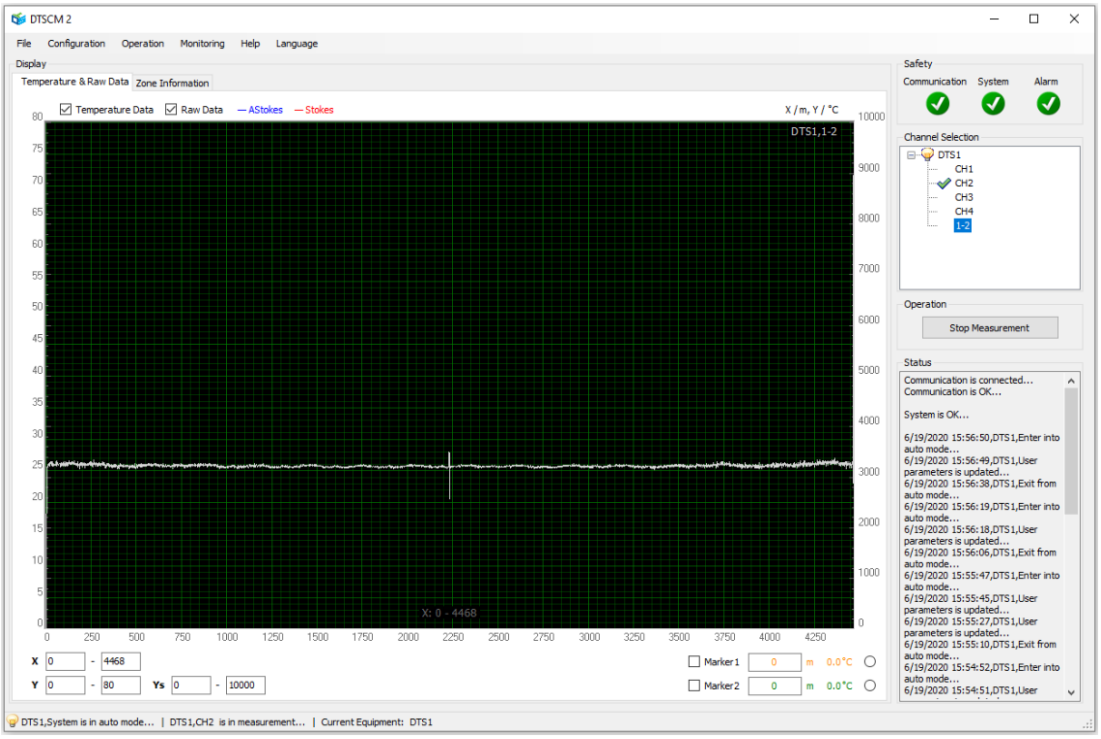


Figure 6-32 Double-ended loop 1-2 temperature trace

6.15 EDFA

Accessed from: Configuration < EDFA

EDFA module configuration only applies to some DTS models; typically to DTS with detection distance more than 5Km. If equipped with an EDFA module, DTS status can be obtained by the reading button on EDFA interface.

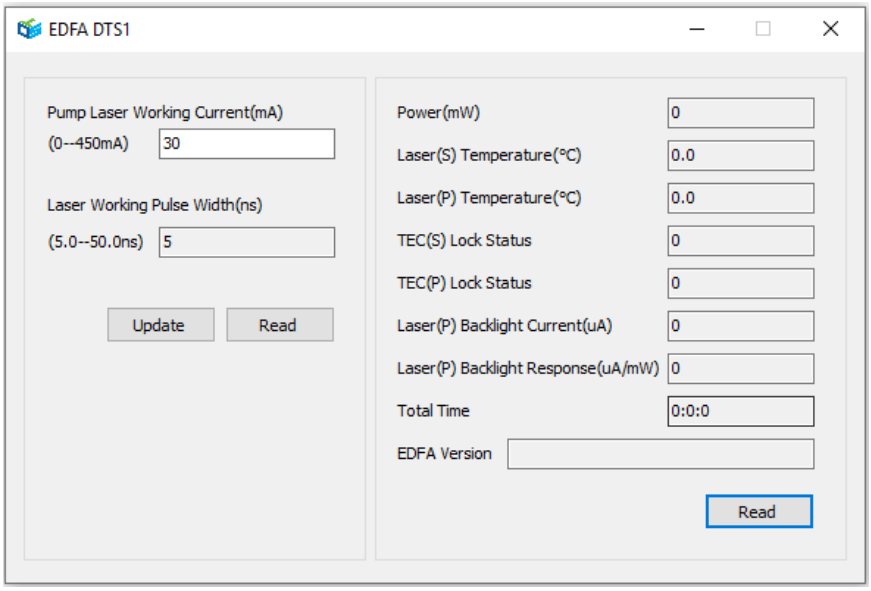


Figure 6-33 EDFA parameters

EDFA update operation is not open to the general user. The user can provide the related information to Bandweaver engineers for support, troubleshooting or failure analysis.

Additionally, if the sensing fiber installed at the project site has vastly different sections of fiber spliced together, the EDFA current may need to be adjusted. In this case, please contact a Bandweaver trained local representative or support@bandweaver.com to organise support.

6.16 Ex Calibration

Accessed from: Configuration < Ex Calibration

In some cases, the sensing cable may be very long and composed of different types of cable spliced together. Each cable segment may have different properties, which may cause the temperature trace of the corresponding channel to exhibit characteristics such as different slopes, different offsets, etc.

In this case, the extended calibration (***Ex Calibration***) function must be used to calibrate each of these sections independently. Designer level or higher access is required to use the extended calibration function. Designers must make the appropriate calibration based on actual sensing fiber that will be used in practice. The ***Ex Calibration*** interface is as shown in Figure 6-34.

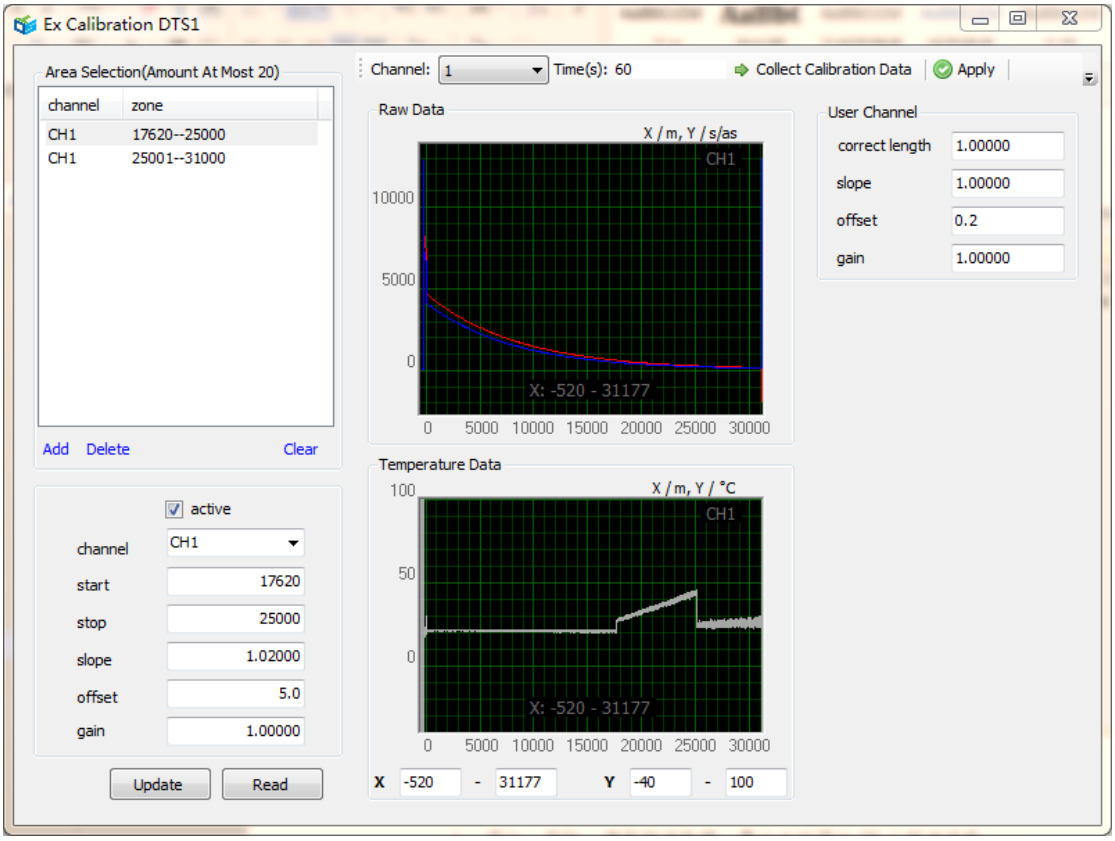


Figure 6-34 Extended calibration interface

Extended calibration contains the following:

Add, Delete, Clear — *Add, Delete or Clear calibration data. Up to 20 calibration parameters are allowed.*

Area Selection — *Lists the current calibration data read or added.*
Click on each area to view the corresponding details in the fields on the right.

Calibration parameters:

Channel — *Channel to be calibrated*

Start	*Start of Area to be calibrated*
Stop	*End of Area to be calibrated*
Slope	*Calibration parameter – refer to Section 6.10.* *Slope of temperature adjustment*
Offset	*Calibration parameter – refer to Section 6.10.* *Adjust the temperature offset.*
Gain	*Calibration parameter – refer to Section 6.10.* *Gain coefficient of the temperature. Do not change. Keep the default value.*
Read, Update	*Read calibration data stored in the extended DTS or update the calibration data to DTS.* *Note: It's strongly recommended that a backup of the .ECP file is made before the operating parameters are changed. Without this, the existing configuration cannot be recovered. See the update prompt Figure 6-13.*

6.17 Network

Accessed from: Configuration < Network

Bandweaver's next-generation DTS integrates three 10/100Mbps adaptive Ethernet network ports. Refer to the hardware manual of your DTS for details of the network ports – see Section 1 for document references of your DTS.

Each card contains the network configuration setting and IP address setting independently provided MAC. If any changes are made, the DTS must be restarted for these to take effect.

The network configuration interface is as shown in Figure 6-35.

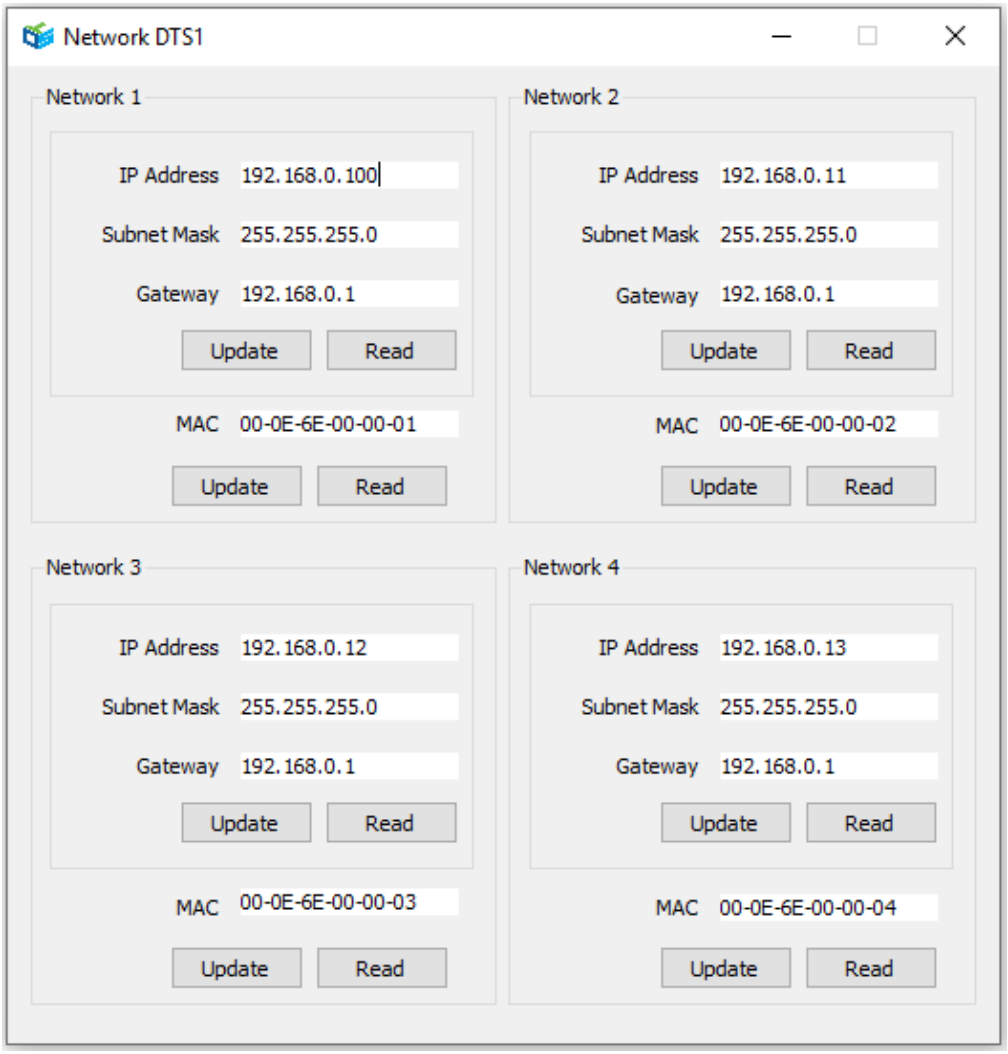


Figure 6-35 Network configuration

DTSCM2 connection types supported by card:

- RJ45-1: UDP (Port:1025)
- RJ45-2: UDP (Port:1025), TCP (Port:1026)

- RJ45-3: UDP (Port:1025), TCP (Port:1026)

Notes:

1. Network 4 is reserved for internal usage. Do not reconfigure it.

2. While all cards – RJ45-1, RJ45-2 and RJ45-3 – can be used with UDP protocol to connect DTSCM2, for long run unattended connections the use of TCP is recommended instead of UDP. For these cases, RJ45-2 or RJ45-3 must be used as RJ45-1 does not support TCP protocol.

6.18 Device ID

Accessed from: Configuration < Device ID

Bandweaver's next-generation DTS supports two RS-485 connections.

The RS-485 settings can be accessed in the interface shown in Figure 6-36. To use a customised mapping register, please contact your local Bandweaver representative.

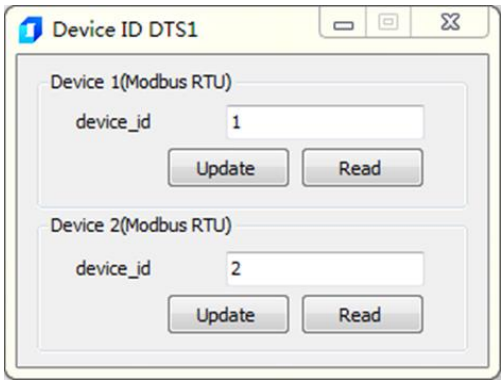


Figure 6-36 Device ID

6.19 Box Temp

Accessed from: Configuration < Box Temp

Reads the DTS temperature inside the internal oven.

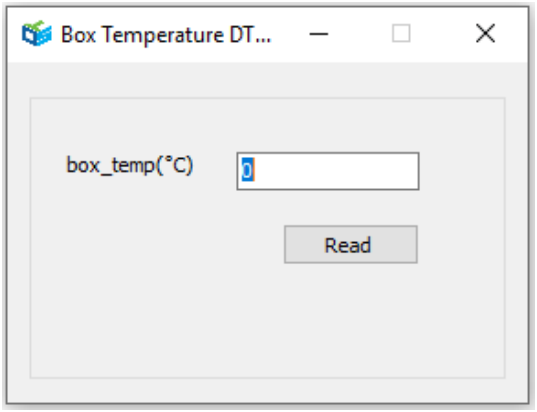


Figure 6-37 – Box temperature display

6.20 Data Sender

Accessed from: Configuration < Data Sender

Data forwarding feature is only available to Designers and higher access levels.

This feature forwards DTS data collected to another PC. This feature is deactivated by default.

Currently only forwarding to a designated target is supported. The target IP and data port must be pre-configured before this feature is turned on.

The Data forwarding configuration interface as shown in Figure 6-38.

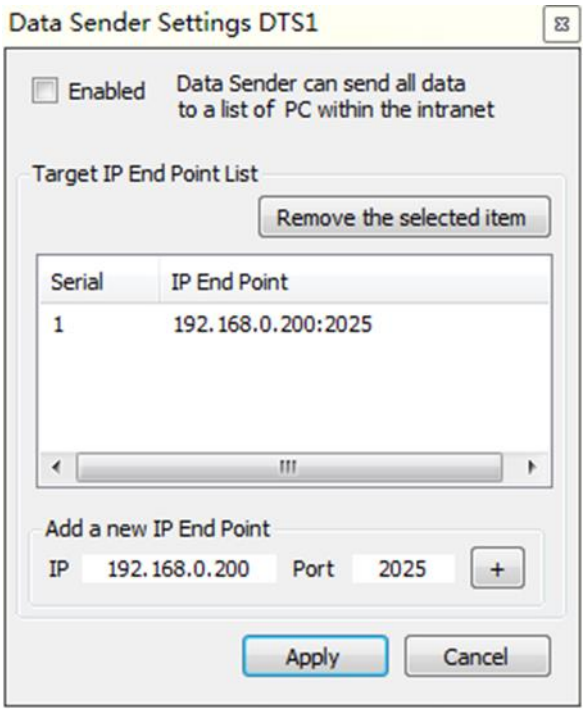


Figure 6-38 Data Sender settings

6.21 Data Storage

Accessed from: Configuration < Data Storage

When DTSCM2 is collecting and uploading data in DTS, it can also optionally save data to the connected PC so save on internal disk space.

Set the data save path in the Data storage interface of the DTSCM2 software as shown in Figure 6-39.

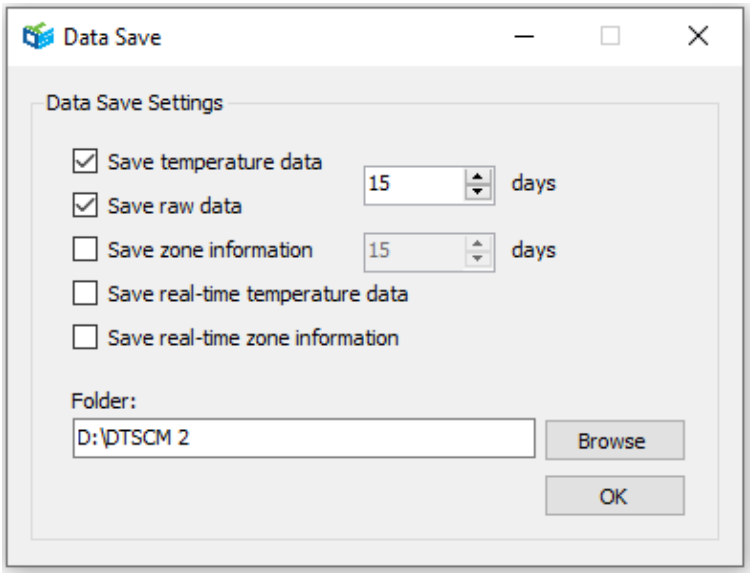


Figure 6-39 Data retention

The temperature data and original data are recorded in the in the same *.hdt data file, and so they share the same save duration parameters.

Set the length of time to save data. When the data record reaches target duration, older files will be deleted, and only the latest data that meets the requirements is retained.

File and Folder naming:

- By default, all the data is stored in D:\DTSCM2\Data
  However, the user can choose to save the data in a different path by updating the ***Folder:*** field in the ***Data Save*** interface – see Figure 6-39.

- The ***Data*** folder contains all the DTS data; Each data file is stored in a sub-folder named after the corresponding DTS. The naming format of this subfolder is:

  <DTS name> - <DTS serial number>; for example: ***DTS1-30910001***

- The DTS name can be set in the initialization. The user can modify the default name, DTS1 to a more intuitive name. See **6.2 Initialize**.

- The DTS serial number is set by the factory and matches the serial number on the DTS nameplate.
  In manual mode, the DTS serial number can be read in the device parameters, see **6.4 Equipment**.

- Each DTS folder contains alarm information, measurement data records, and measurement data at the time of the alarm, and keeps it in the Alarm, CHx, and Data Exception folders:

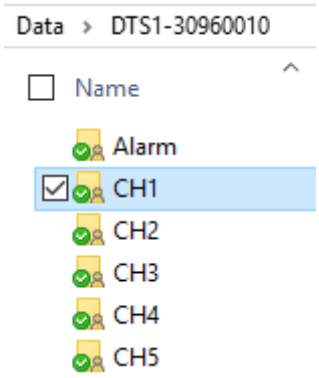


Figure 6-40 Data Folder structure

- The DTS can save the data obtained for each measurement as a *.hdt file. The name format is HH-MM-SS.hdt, and the save path is CHx\YY-MM-DD. A folder is generated daily based on the current date.

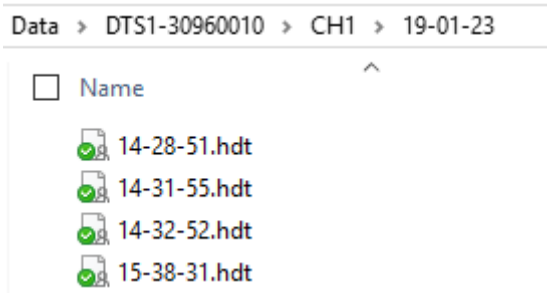


Figure 6-41 .hdt file naming

When the data record stops meeting the data retention conditions, i.e. 15 days in the example shown in Figure 6-39, the outdated data is deleted when the folder deletion operation is next performed.

6.22 Password Administration

Accessed from: Configuration < Password Administration

The password management function is only available to Designers and higher access levels.

This interface lets the Designer set the edit mode password, the stop/start measurement password, and reset the password. The general user does not need to edit any of the default passwords to complete the basic configuration.

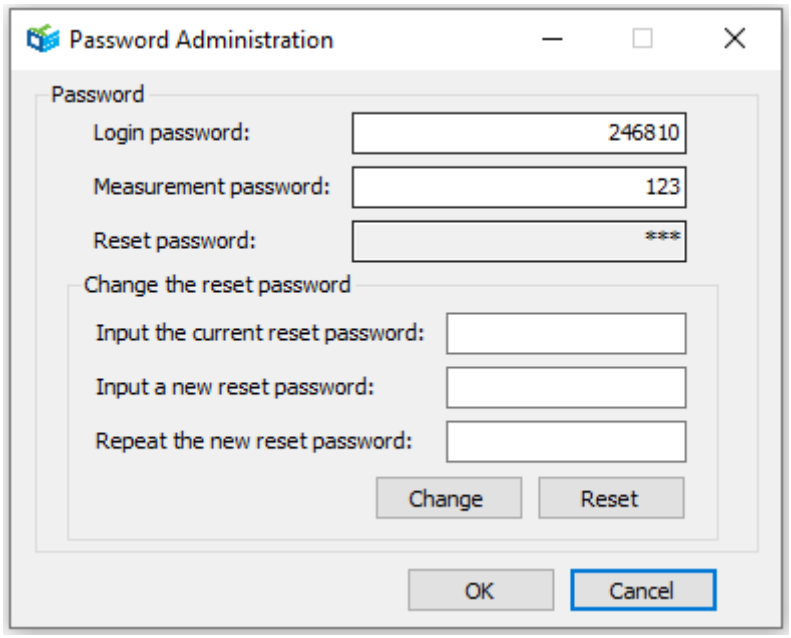


Figure 6-42 Password Administration

Measurement password is used to start or stop the measurement. The reset password is used to clear the alarms.

Measurement password default value: 123

7 Menu – Operation

The Operation menu is the same for all user access levels, and is shown in Figure 7-1.

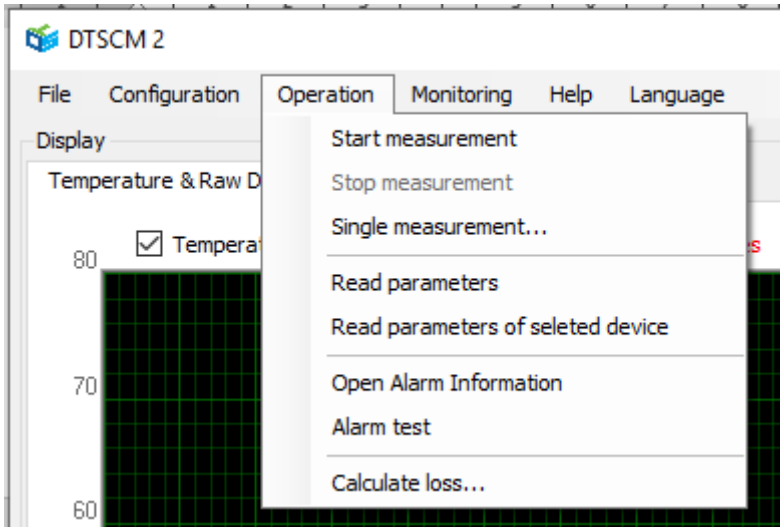


Figure 7-1 Operation Menu

7.1 Operation – Start measurement

Accessed from: Operation < Start Measurement

The operation of entering the automatic measurement or exiting the automatic measurement in batches (the default measurement password is 123) is different from the start measurement of the main interface.

This operation is a batch operation, and multiple DTS devices connected to the DTSCM2 software can be started at the same time.

7.2 Operation – Stop Measurement

Accessed from: Operation < Stop Measurement

The operation of entering the automatic measurement or exiting the automatic measurement in batches (the default measurement password is 123) is different from the start measurement of the main interface.

This operation is a batch operation, and multiple DTS devices connected to the DTSCM2 software can be stopped at the same time.

7.3 Operation – Single Measurement

Accessed from: Operation < Single Measurement

This option is selected if the user requires a single measurement of the specified channel in manual mode. The single measurement interface is as shown in Figure 7-2.

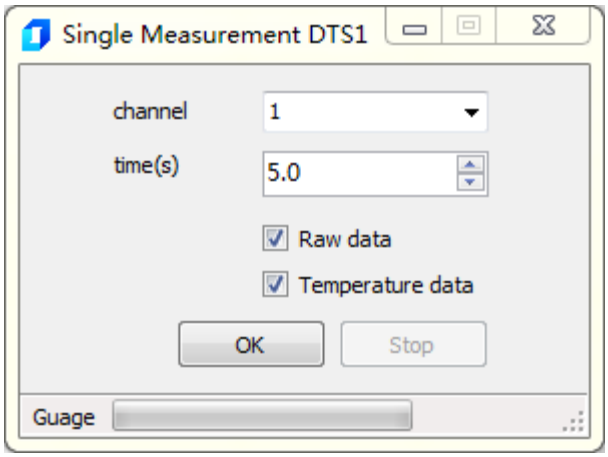


Figure 7-2 Single Measurement

Select the ***channel*** number from the drop-down list, the ***time(s)***, and used the checkboxes to select the type of data received. The ***time(s)*** is the measurement time. Click the ***OK*** button.

The progress bar below displays the measurement progress. This channel must then be selected in the ***Channel Selection*** panel to display the measurement output in the graphics display region.

7.4 Operation – Read Parameters

Accessed from: Operation < Read Parameters

The DTS can operate independently of the DTSCM2 software. However, if the DTSCM2 requires a correct curve display, it must obtain the parameters of the connected DTS. This command is not required for automatic measurement. However, for non-automatic measurements, this command allows DTSCM2 to read the parameters of all the connected DTS devices at once. To read the parameters of a single DTS, use the Read Parameters of Selected Device command detailed in Section 7.5.

First ensure that DTS is in manual mode. Then use this command to get the parameters saved on DTS.

This menu is the execution operation, and the Status panel on the right displays the result of the operation.

7.5 Operation – Read Parameters of Selected Device

Accessed from: Operation < Read Parameters of Selected Device

The DTS can operate independently of the DTSCM2 software. However, if the DTSCM2 requires a correct curve display, it must obtain the parameters of the connected DTS. This command is not required for automatic measurement. However, for non-automatic measurements, this command allows DTSCM2 to read the parameters of the selected DTS. To read the parameters of all the connected DTS devices at once, use the Read Parameters command detailed in Section 7.4.

After DTSCM 2 establishes a connection with DTS, ensure that DTS is in manual mode. Then use this command to get the parameters saved on DTS.

This menu is the execution operation, and the Status panel on the right displays the result of the operation.

7.6 Operation – Open the alarm zone

Accessed from: Operation < Open the Alarm Zone

The alarm zone interface displays details of the alarm information of the selected DTS, such as:

- Time;
- Alarm type;
- Channel number;
- Zone ID;
- Position;
- Alarm value;
- Relay triggered by the alarm;

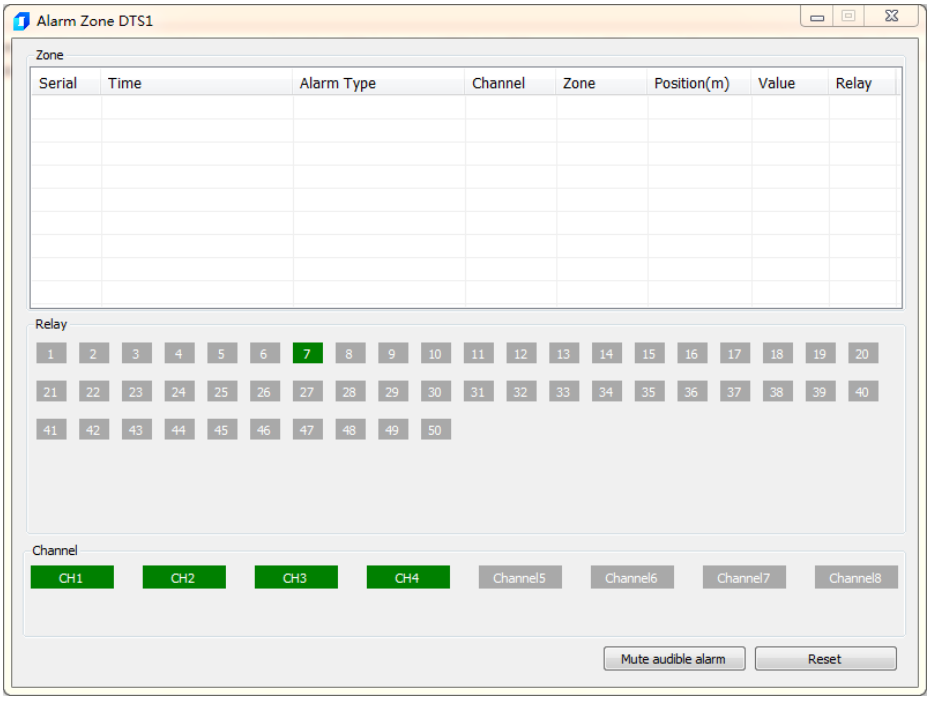


Figure 7-3 Alarm Partition Interface

If DTSCM2 is connected to DTS in normal operation, the Alarm Zone window pops up automatically when an event occurs and displays an alarm message. The user can use the controls in the pop-up window ***Mute the audible alarm*** or ***Reset*** the alarm. A password is required to reset the alarm.

The default password for alarm reset is ***119***

7.7 Operation – Alarm test

Accessed from: Operation < Alarm test

This self-check command interface can be used to test the DTS visual and audible alarm and fault indicators, and also to test correct functioning of the relays. the interface is shown in Figure 7-4.

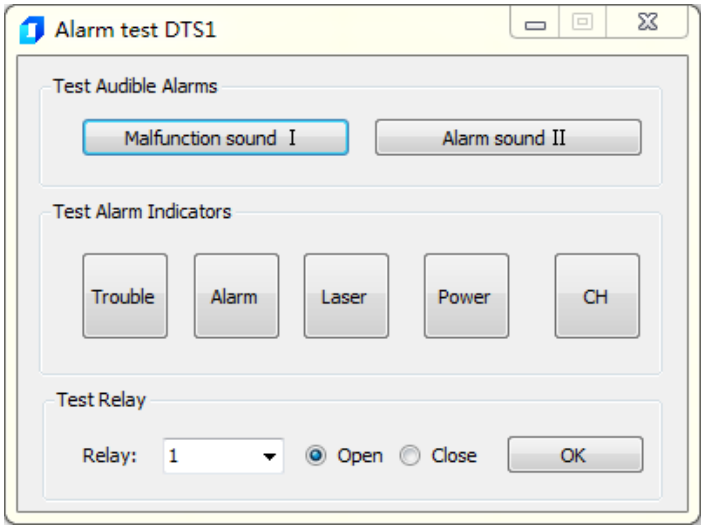


Figure 7-4 Alarm test interface

7.8 Operation – Calculate loss

Accessed from: Operation < Calculate loss

DTSCM2 provides this ***Calculate loss*** function to calculate the loss between two points of the fiber. The optical loss calculation interface and examples are as shown in Figure 7-5.

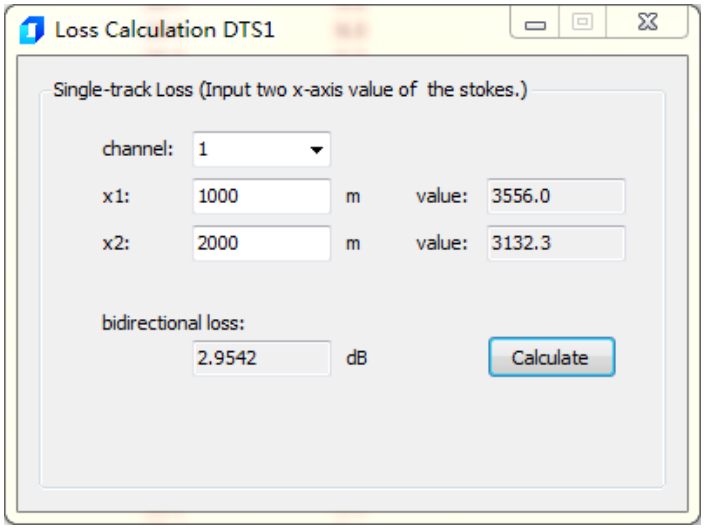


Figure 7-5 Loss calculation interface

1) First select the ***channel*** number from the drop-down menu;
2) Enter the starting position X1 and the ending position X2;
3) Click the Calculate button

The software calculates the optical path bidirectional loss based on the input conditions and a specific algorithm.

8 Monitoring

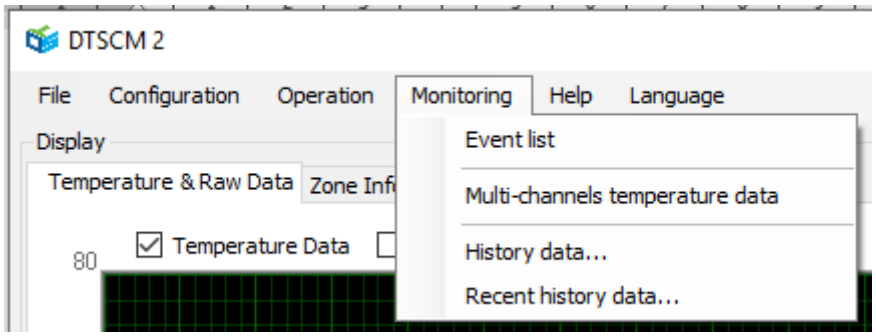


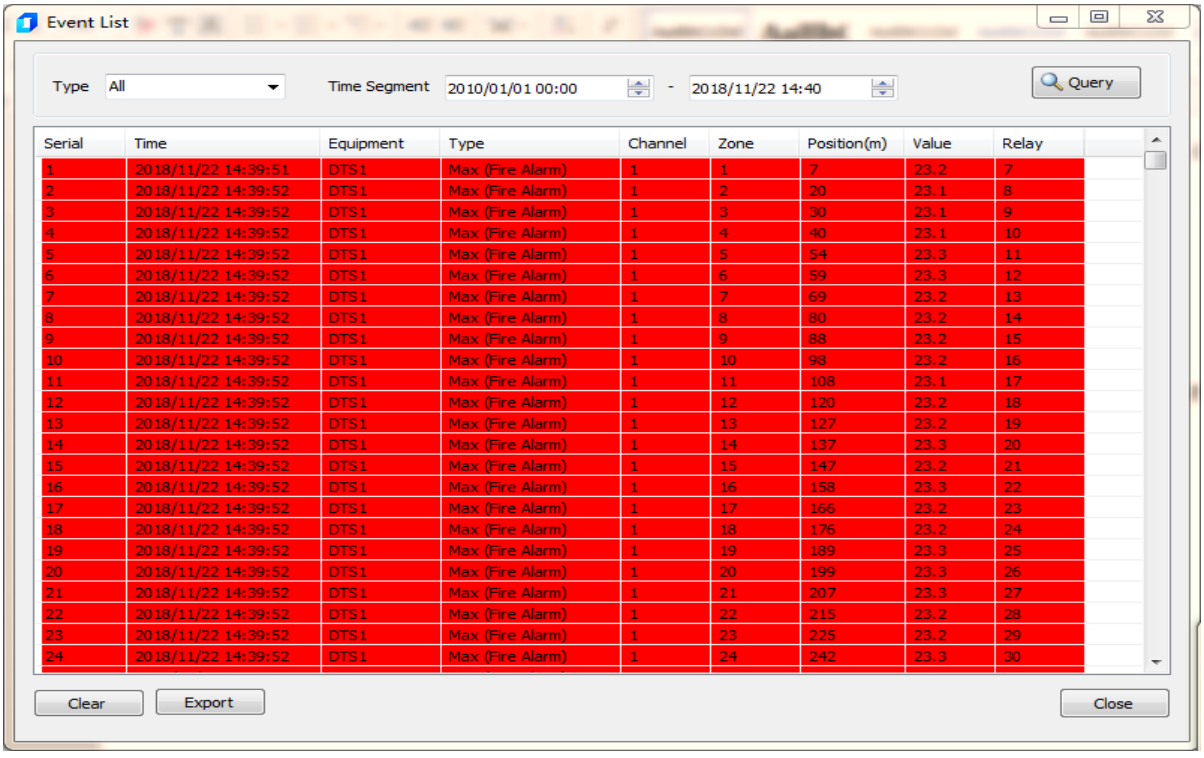
Figure 8-1 Monitoring menu

8.1 Event list

Accessed from: Monitoring < Event list

The Event list records all alarm information and reset operation since the program was launched. The list can be queried by type (fire, fault, all) and time period. Alarm records can also be exported or cleared.

An example of an event list is as shown in Figure 8-2.



Serial	Time	Equipment	Type	Channel	Zone	Position(m)	Value	Relay
1	2018/11/22 14:39:51	DTS1	Max (Fire Alarm)	1	1	7	23.2	7
2	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	2	20	23.1	8
3	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	3	30	23.1	9
4	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	4	40	23.1	10
5	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	5	54	23.3	11
6	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	6	59	23.3	12
7	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	7	69	23.2	13
8	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	8	80	23.2	14
9	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	9	88	23.2	15
10	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	10	98	23.2	16
11	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	11	108	23.1	17
12	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	12	120	23.2	18
13	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	13	127	23.2	19
14	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	14	137	23.3	20
15	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	15	147	23.2	21
16	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	16	158	23.3	22
17	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	17	166	23.2	23
18	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	18	176	23.2	24
19	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	19	189	23.3	25
20	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	20	199	23.3	26
21	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	21	207	23.3	27
22	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	22	215	23.2	28
23	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	23	225	23.2	29
24	2018/11/22 14:39:52	DTS1	Max (Fire Alarm)	1	24	242	23.3	30

Figure 8-2 Event List

8.2 Multi-channels temperature data

Accessed from: Monitoring < Multi-channels temperature data

The multi-channel temperature data interface allows multiple channels (up to a maximum of four) to be selected to simultaneously view their temperature data in real time.

The temperature trace of each channel is displayed in a different colour, with the key available for reference just about the chart area, as shown in Figure 8-3.

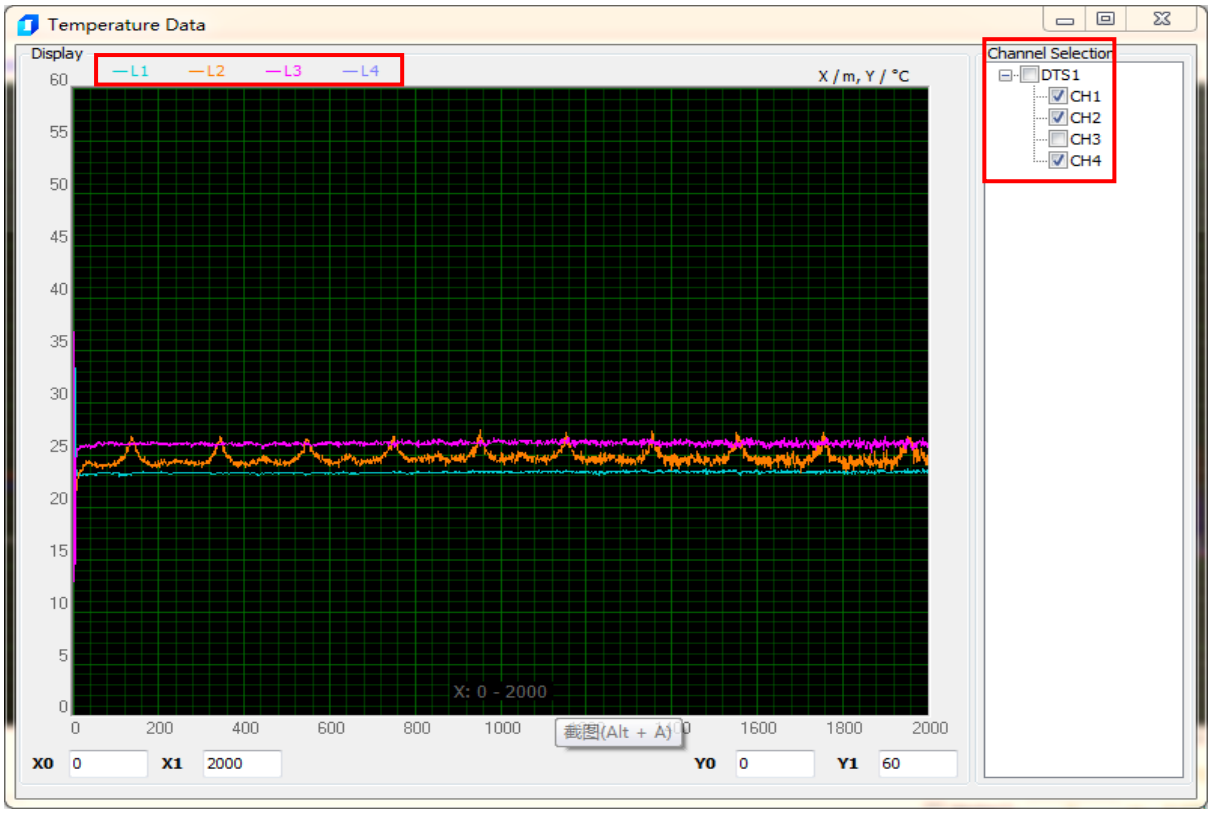


Figure 8-3 Multi-channel temperature data

The chart area may be optimised by adjusting the values of the x and y axes at the bottom of the interface. Type in the required value and press ***Enter*** for the changes to take effect.

8.3 History data

Accessed from: Monitoring < History data

Historical data saved by DTSCM2 can be viewed by the user by selecting this option.

Clicking on this menu item launches a Windows popup to browse and open a file. Select a Historical Data File type with an ***.hdt*** extension in the file dialog to view the historical data.

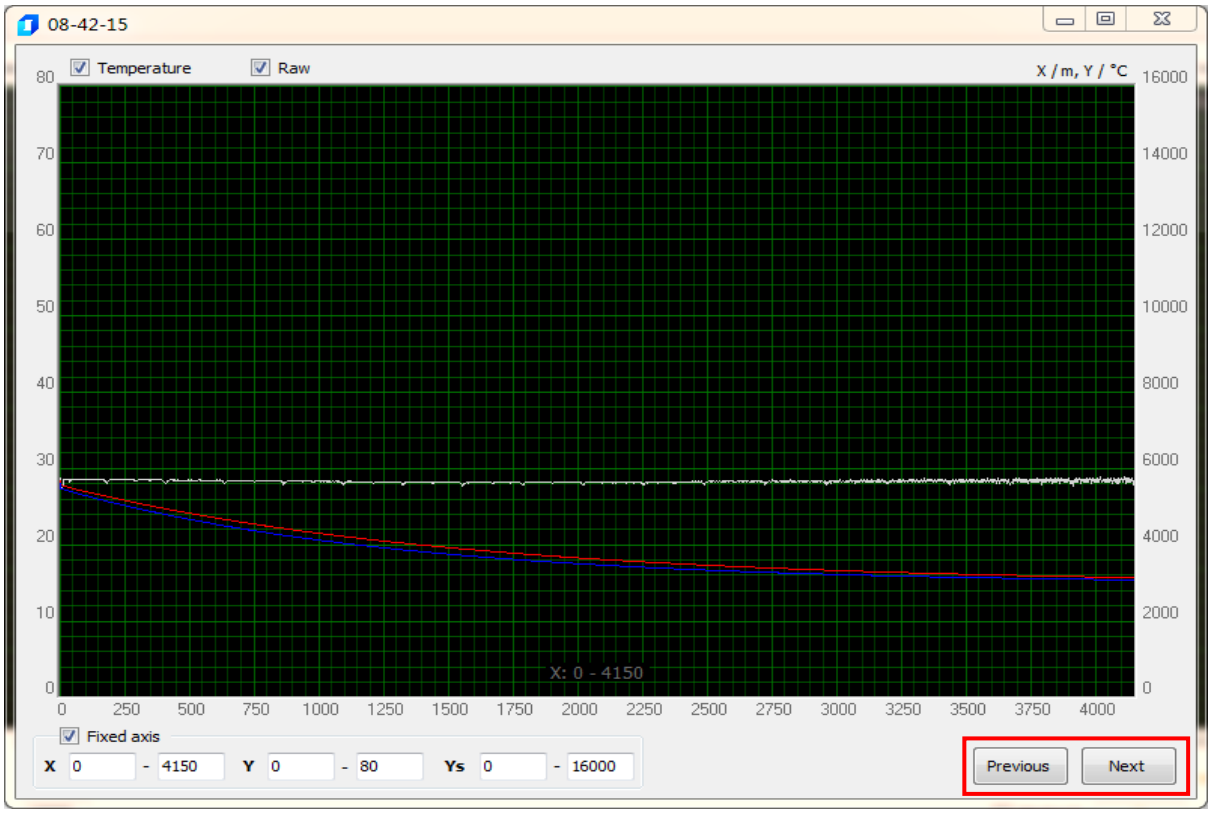


Figure 8-4 Historical data

If the current folder contains multiple historical data files, you can click the “Previous” or “Next” button to play back historical data. The historical data interface is as shown in Figure 8-4.

The chart area may be optimised by adjusting the values of the x and y axes at the bottom of the interface. Type in the required value and press ***Enter*** for the changes to take effect.

8.4 Recent history data

Accessed from: Monitoring < Recent history data

View the latest saved historical data.

Use this feature to quickly locate a save folder of the most recent historical data. The data may be viewed by following the same instructions detailed in Section 8.3 above.

9 Menu – Help

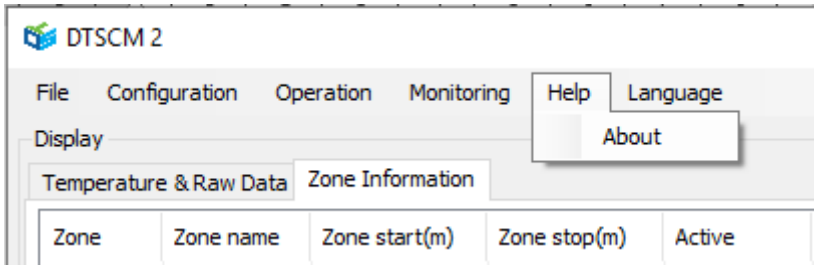


Figure 9-1 Help menu

9.1 About

Accessed from: Help < About

This interface displays the software information of DTSCM2, such as the version number, version release date, and operating environment.

An example is as shown in Figure 9-2.

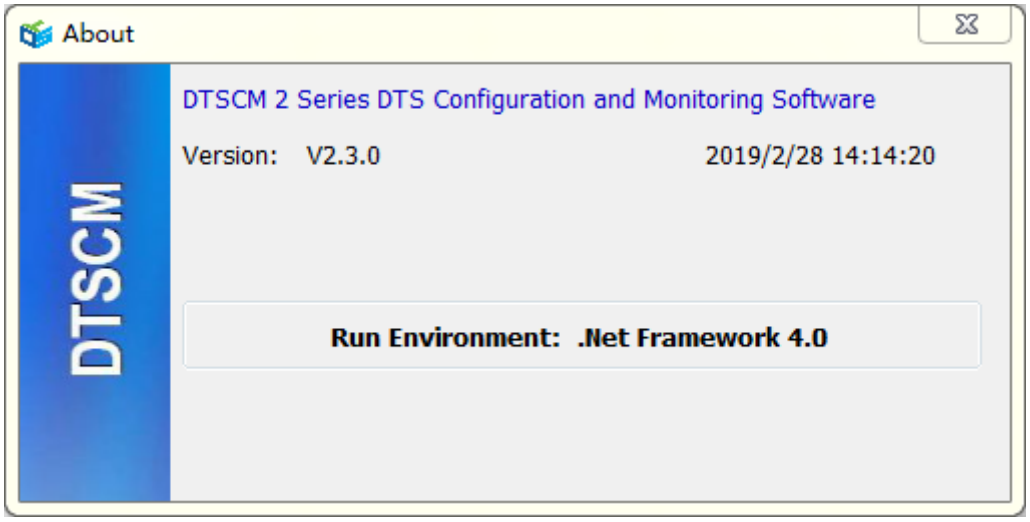


Figure 9-2 Version information- About

10 Alarms

When an alarm is triggered, the following windows pops up in the DTSCM2 software.

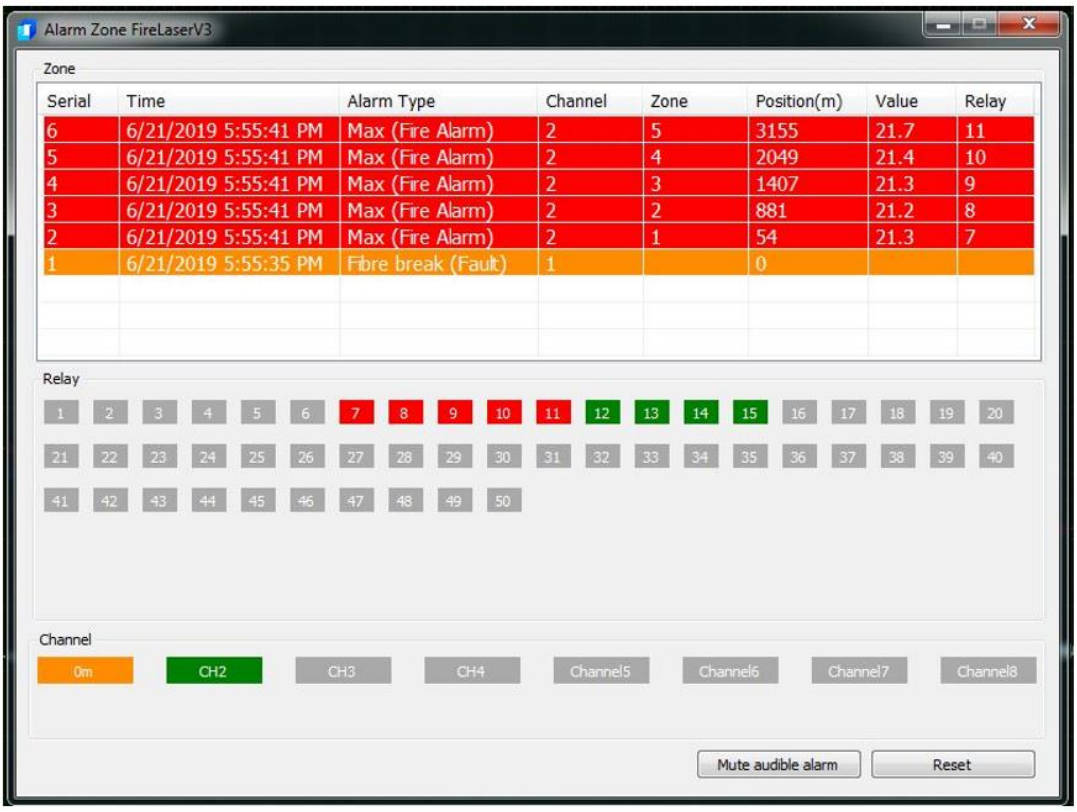


Figure 10-1 Alarm Pop-up

Zone:
Alarm events are highlighted in red and fault events in orange.

Relay:
The relay section provides an overview of the relay status and are colour-coded to show their status:

Greyed-out relay number *Relay not associated with any zones or alarms*

Green relay number *Associated with a zone but healthy status – not in alarm state*

Red relay number *Zone associated with this relay is in an alarm state*

Channel:
The channel section provides an overview of the status of the channels of the DTS. Using the example of Figure 10-1:

- Channel 1 has a fiber break at 0m
- Channel 2 is measuring correctly (note that the green colour here does not represent the alarm state. Channel 2 has active alarms in several zones)
- Channels 3 to 8 are not in use

10.1 Alarm Events

Alarms are raised for the following types of events when the appropriate conditions for the alarm are fulfilled:

- An optical fiber is broken (fault event);
- 3 levels of high temperature alarms – Max alert 1, Max alert 2, Max;
- Low temperature alarm – min;
- Sudden temperature rise – change rate;
- Temperature spike – deviation;

When a temperature alarm event is triggered, the following occurs within the DTSCM2 interface:

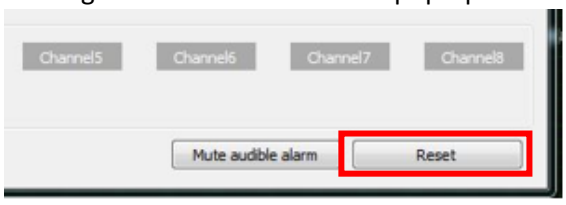
- The alarm indicator changes from green to red:

- The event is displayed in the Alarm Zone pop-up, along with key details such as, channel number, zone ID, type of alarm, location, temperature and timestamp of the alarm – see Figure 10-1;
- An alarm pop-up is displayed on the LCD interface of the DTS;
- The relevant relay contact(s) are triggered;
- The status of the alarm is available via the MODBUS interface

10.2 Alarm reset

Alarms can be reset by:

- Clicking Reset in the Alarm Zone pop-up:



- Via the LCD display of the DTS

Resetting the alarms will also release any corresponding relays.

A password is required to reset the alarm. The default password for alarm reset is 119

10.3 Historical Alarm information

Alarm information is stored in the following location: \Data\<*DTSname-SerNo*>\alarm\<date>

11 Troubleshooting

11.1 DTSCM 2 Flowchart

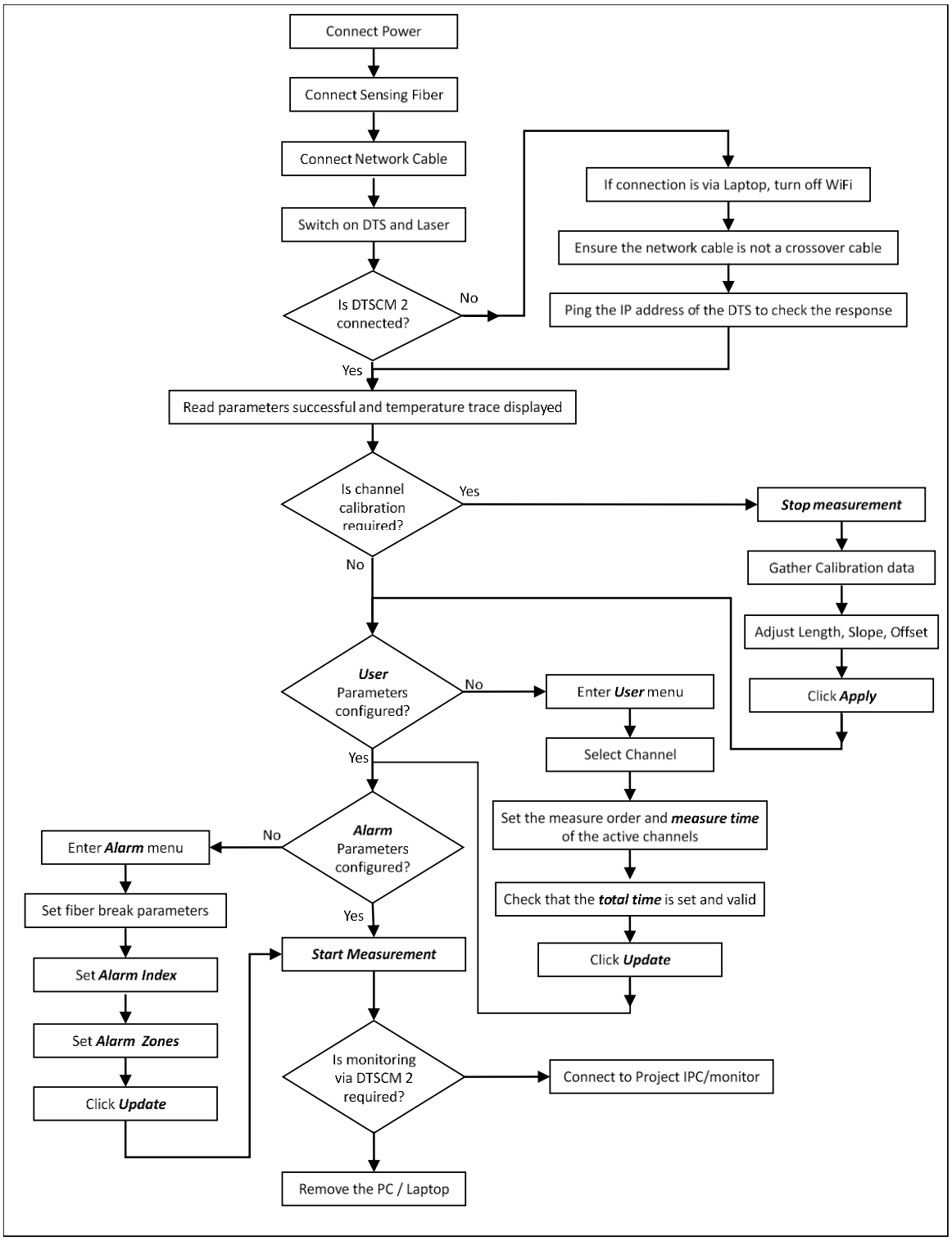


Figure 11-1 Quick Start or Troubleshooting flow chart

11.2 Troubleshooting pointers

Problem	Common causes	Recommended solution
DTSCM software does not run	- *Microsoft .NET Framework 4.0 is not installed on the PC*	- *Install .net Framework 4.0*
DTS is operating but no temperature curve is displayed	- *The correct channel is not selected in the Channel Selection panel*	- *Click on the channel of interest to select it*
DTS does not alarm for high temperature	- *No zones have been configured.* - *No alarm index has been configured, or incorrectly configured* - *Zones have been configured, but for a different channel to the one under test*	- *Alarms are output from the zones. Make sure the channel under test has at least one zone configured and that the meters of fiber being tested are included in this zone.* - *Make sure the alarm index allocated to the zone has the temperature thresholds set correctly*
DTS measures some channels but not others	- *Measure order has not been set correctly*	- *In **Configuration** < **User**, check the measure order field for the measurement sequence of the channels. The default is 1-2-…-n, to measure all channels in sequence, where n is the total number of channels of the DTS.* - *Refer to Section 6.12.*
DTS takes too much time to measure	- *Measurement time or total time have been set too long.*	- *In **Configuration** < **User**, check the **measure time(s)** field and **total time(s)** field. The measure time field is the measurement time for each channel.* - *Refer to Section 6.12*
Too much noise temperature curve	- *The overall loss of the sensing cable is too large;* - *The quality of the splice is inadequate* - *The pigtail connector is not clean*	- *Clean the pigtail connector* - *Make sure the fiber bend radius is respected* - *Remake the splice if necessary*
Slope of the temperature curve of different	- *Different fiber types are connected together;*	- *Examine the optical fiber in use*
The temperature curve shows a step change at the fiber joint	- *The connector is dirty;* - *Large loss at the joint;* - *Different fiber types are connected together;*	- *Clean Connectors* - *Reconnect the fiber*
Data collection error	- *The temperature range of the laser is uncontrolled*	- *Reboot the system*
Fatal Error	- *Communication error*	- *Reboot the system*

No data is received	- *Communication interface display is disconnected*	- *Ping the device to ensure network connectivity*
The raw data is almost zero	- *Laser disabled, or the fiber optic cable is not inserted*	- *Check the optical fiber connector* - *Turn on the laser*

If any problem persists or if the user is unable to resolve it, please contact Bandweaver or an authorized distributor.

Please include the following information when requesting support:

1. Serial number of the product. This is located on the rear panel of the product;
2. Full description of the problem and any troubleshooting measures already attempted;
3. User profile (ECP file) in use when the failure occurred;
4. Data files while the issue is experienced. The data files can be found in the **data** subdirectory (**default D:\DTSCM2**).

12 Contacts

Please refer to the contact page of the following webpages for details to contact Bandweaver:

English: www.bandweaver.com

Chinese: www.bandweaver.cn

Or email us on support@bandweaver.com