

E+PLC

E+PLC 100 User Guide

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Eurotherm[®]

by **Schneider** Electric

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Safety Information

Important Information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this manual or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER
DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING
WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE
NOTICE is used to address practices not related to physical injury.

Safety Notes

WARNING

WARNING Any interruption of the protective conductor inside or outside the apparatus, or disconnection of the protective earth terminal is likely to make the apparatus dangerous under some fault conditions. Intentional interruption is prohibited.

WARNING

WARNING Live sensors: The unit is designed to operate if the temperature sensor is connected directly to an electrical heating element. It must be ensured that service personnel do not touch connections to such inputs whilst the inputs are live. With live sensors, all cables, connections and switches for connecting the sensor must be mains rated for use in 240 V Cat II.

WARNING

WARNING Grounding the temperature sensor shield: Where it is common practice to replace the temperature sensor whilst the instrument is live, it is recommended that the shield of the temperature sensor be grounded to a protective earth cable, as an additional protection against electric shock.

WARNING

WARNING The instrument must not be wired to a three-phase supply with an unearthed star connection, because, under fault conditions, such a supply could rise above 240 V RMS with respect to ground, thus rendering the instrument unsafe.

1. This instrument is intended for industrial control applications within the requirements of the European directives on safety and EMC.
2. Installation may be carried out only by qualified personnel.
3. To prevent hands or metal tools coming into contact with parts that are electrically live the instrument must be installed in an enclosure.
4. Where conductive pollution (e.g. condensation, carbon dust) is likely, adequate air conditioning/filtering/sealing etc. must be installed in the enclosure.
5. The instrument is fitted with an over current protection device which is not user serviceable. If it is suspected that this has failed, the manufacturer's local service centre should be contacted for advice.
6. Whenever it is likely that protection has been impaired, the unit shall be made inoperative, and secured against accidental operation. The manufacturer's nearest service centre should be contacted for advice.
7. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.
8. The unit must be wired according to the instructions in this manual.

9. Before any other connection is made, the protective earth terminal shall be connected to a protective conductor. The mains (supply voltage) wiring must be terminated in such a way that, should it slip, the Earth wire would be the last wire to become disconnected. The protective earth terminal must remain connected (even if the equipment is isolated from the mains supply), if any of the I/O circuits are connected to hazardous voltages (A full definition of 'Hazardous' voltages appears under 'Hazardous live' in BS EN61010. Briefly, under normal operating conditions, hazardous voltages are defined as being > 30 V RMS (42.2 V peak) or > 60 V dc.)

The protective earth connection must always be the first to be connected and the last to be disconnected.

Wiring must comply with all local wiring regulations, e.g. in the UK, the latest IEEE wiring regulations (BS7671) and in the USA, NEC class 1 wiring methods.

10. Signal and supply voltage wiring should be kept separate from one another. Where this is impractical, shielded cables should be used for the signal wiring.
11. The maximum continuous voltage applied between any of the following terminals must not exceed 240 V ac.
 - a. Relay output to logic, dc or sensor input connections.
 - b. Any connection to ground.

The ac supply must not be connected to sensor input or low-level inputs or outputs.

12. Over temperature protection: A separate over-temperature protection unit (with an independent temperature sensor) should be fitted to isolate any process heating circuit should a fault condition arise.
Alarm relays within the instrument do not give protection under all fault conditions.
13. In order to allow the power supply capacitors to discharge to a safe voltage, the supply must be disconnected at least two minutes before the instrument is removed from its sleeve. Touching exposed electronics in an instrument which has been removed from its sleeve should be avoided.
14. Instrument labels may be cleaned using isopropyl alcohol, or water or water-based products. A mild soap solution may be used to clean other exterior surfaces.

Equipment and personnel protection

1. The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure.
2. Separate or redundant control paths must be provided for critical control functions.
3. System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
4. Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

Safety requirements for permanently connected equipment state

1. A switch or circuit breaker shall be included in the building installation.
2. It shall be in close proximity to the equipment and within easy reach of the operator.
3. It shall be marked as the disconnecting device for the equipment.
4. Recommended external fuse ratings are: 2 A Type T 250 V.

Backup battery

1. This instrument is fitted with a battery designed to retain configuration and other data in the event of failure of the power supply to the instrument.
2. The battery has an expected life of > 1 year unpowered at nominal operating temperature of 25°C, but this may be reduced if the instrument is operated at elevated temperatures. Low battery indication must be programmed into the application by the designer.
3. The battery is not user serviceable.

USB device precautions

NOTICE

NOTICE The use of U3 USB Flash drives is not recommended.

1. Precautions against electrostatic discharge should be taken when the instrument terminals are being accessed. The USB and Ethernet connections are particularly vulnerable.
2. Ideally, the USB device should be plugged directly into the instrument, as the use of extension leads may compromise the instrument's ESD compliance. Where the instrument is being used in an electrically 'noisy' environment, however, it is recommended that the user brings the USB socket to the front of the panel using a short extension lead. This is because the USB may 'lock up' or reset in noisy environments and the only means of recovery is to remove the device, then re-insert it. For memory sticks, EMC-related failure during a write operation might cause corruption of the data held on the stick. For this reason, the data on the memory stick should be backed up before insertion and checked after removal.
3. When using a USB extension cable, a high quality screened cable must be used. The total length of USB cable between the device and the USB port must not exceed 3 metres (10 feet).

Symbols used on the instrument labelling

One or more of the symbols below may appear either as a part of the labelling of the items comprising this instrument. In some cases, symbols may be incorporated in the moulding or stamped on the metalwork.

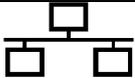
Symbol	Meaning
	Refer to the user guide for instructions.
	Protective earth ground conductor terminal
	Precautions against electrostatic discharge must be taken before handling this unit or any electronic component of it.
	Complies with the RoHS2 (2011/65/EU) directive.
	For environmental reasons, this product must be recycled before its age exceeds the number of years shown in the circle.
	Underwriters Laboratories listed mark for the United States and Canada.
	This unit is CE compliant.
	RCM. R egulatory C ompliance M ark for Australia and New Zealand.
	Ethernet connector.
	USB connector.
	Risk of electric shock.

Table 1: Symbols used on the E+PLC100

Introduction

What's in this User Guide

This document describes the installation of the E+PLC 100 hardware, an explanation of the default application and an introduction to CODESYS software. The instrument comes with four input channels as standard. It is equipped for secure archiving via FTP transfer and/or to USB memory stick.

Unpacking the instrument

The instrument is despatched in a special pack, designed to give adequate protection during transit. Should the outer box show signs of damage, it should be opened immediately, and the contents examined. If there is evidence of damage, the instrument should not be operated and the local representative contacted for instructions. After the instrument has been removed from its packing, the packing should be examined to ensure that all accessories and documentation have been removed. The packing should then be stored against future transport requirements.

Installation

What's in this section

This section gives details on the mechanical and electrical installation of the E+PLC 100.

CAUTION

Before installation, ensure that the specified instrument supply voltage matches the facility supply.

Mechanical installation

See [Figure 1](#) for installation details.

Installation Procedure

1. If it is not already in place, fit the sealing gasket behind the front bezel of the instrument.
2. Insert the instrument through the panel cutout, from the front of the panel.
3. Spring the retaining clips into place, and secure the instrument by holding it firmly in place whilst pushing both clips towards the rear face of the panel.
4. The protective membrane can now be removed from the display.

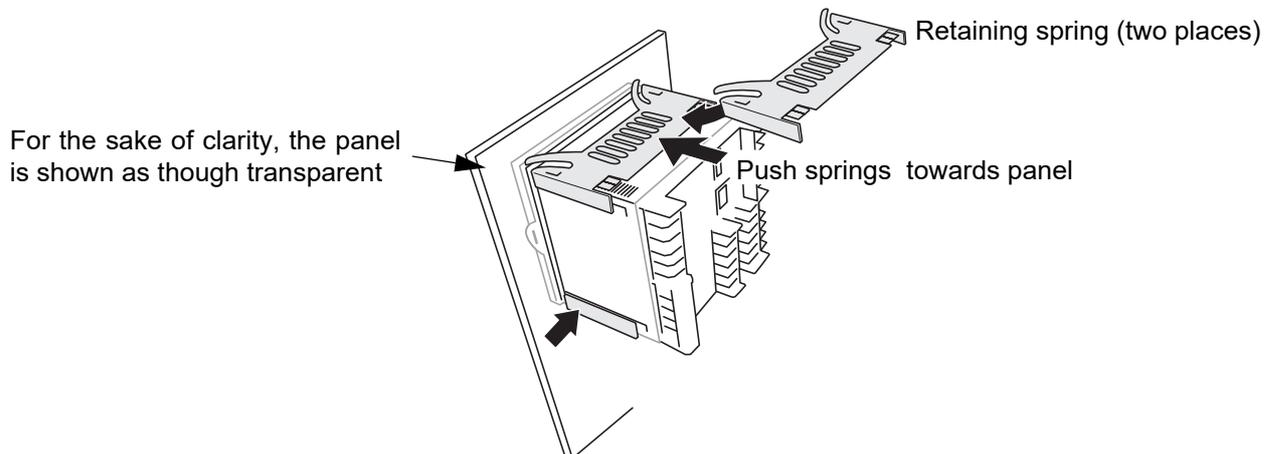


Figure 1 Securing the Instrument

Demounting

This section describes un-installation of the complete instrument including the sleeve.



WARNING

Before removing the supply voltage wiring, isolate the supply voltage and secure it against unintended operation.

1. Isolate the mains supply and secure it against accidental operation. Remove all wiring and the USB device and Ethernet cable (if any).
2. Remove the retaining springs by unhooking them from the sides using a small flat-blade screwdriver.
3. Pull the instrument forwards out of the panel.

Removing the Instrument from its Sleeve

The instrument is designed to be removed from its sleeve from the front panel. However, if a USB memory stick or the Ethernet cable is fitted then this must be removed first.

When the instrument is shipped from the factory it is fitted with two small red clips, one in the top side of the sleeve and the other below. These are intended as a safeguard against removal of the instrument from its sleeve when an Ethernet cable is fitted. These clips must also be removed, using a small screwdriver, before the instrument can be taken out of its sleeve.

Ease the latching ears outwards (see illustration overleaf) and pull the controller forward.

When plugging back in ensure that the latching ears click into place to maintain the panel sealing.

Dimensions and Panel Cut Out

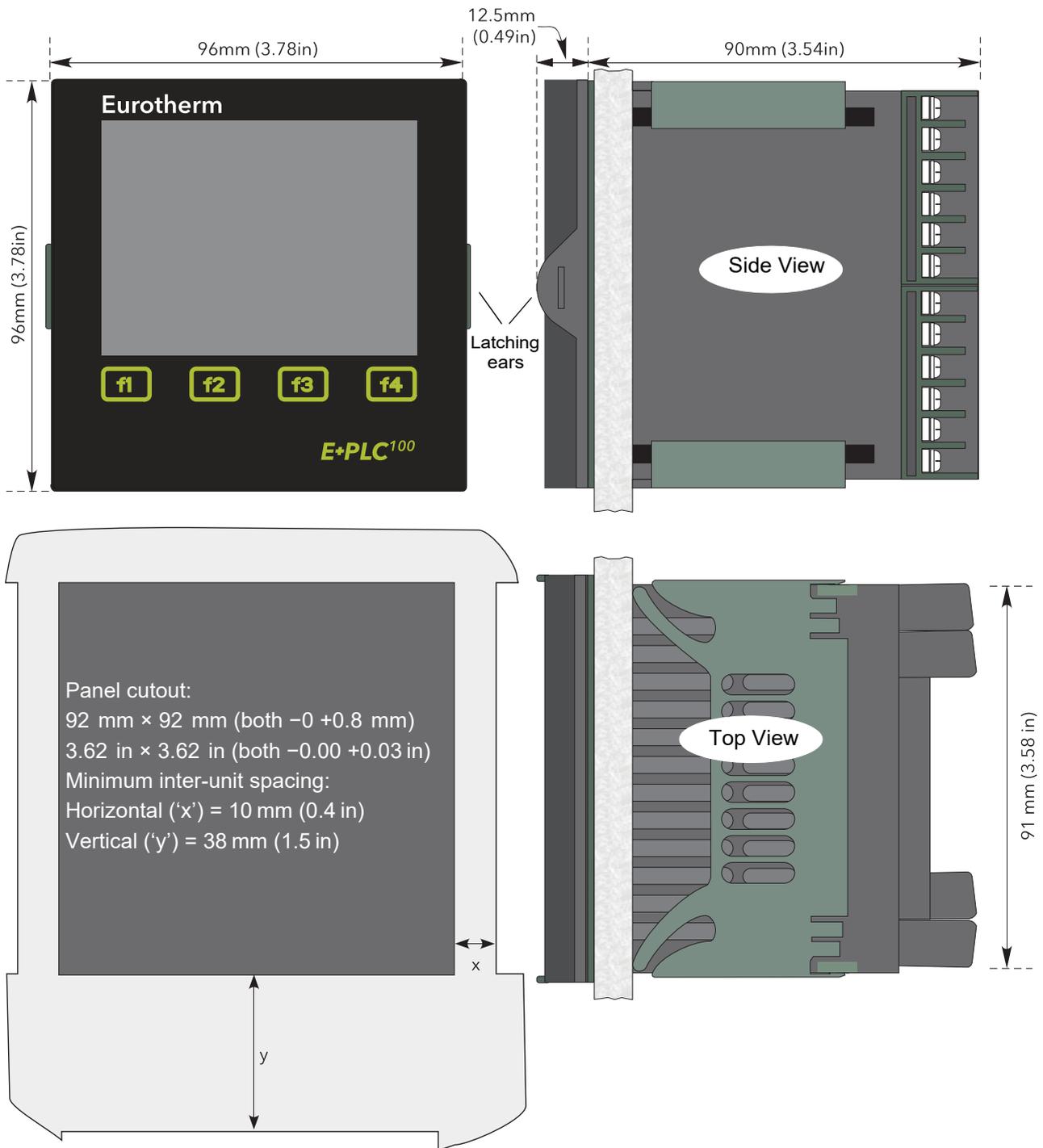


Figure 2: Mechanical installation details

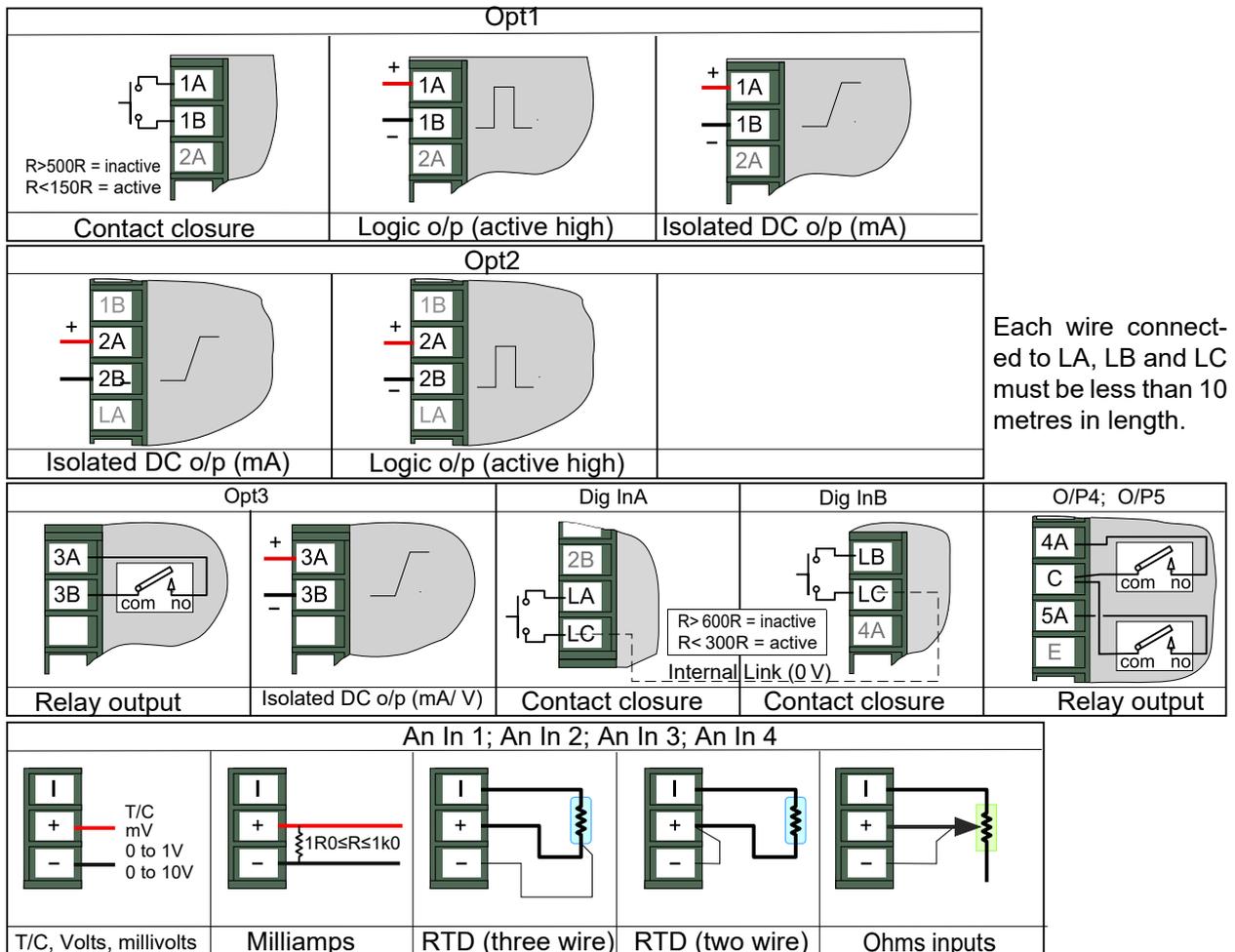
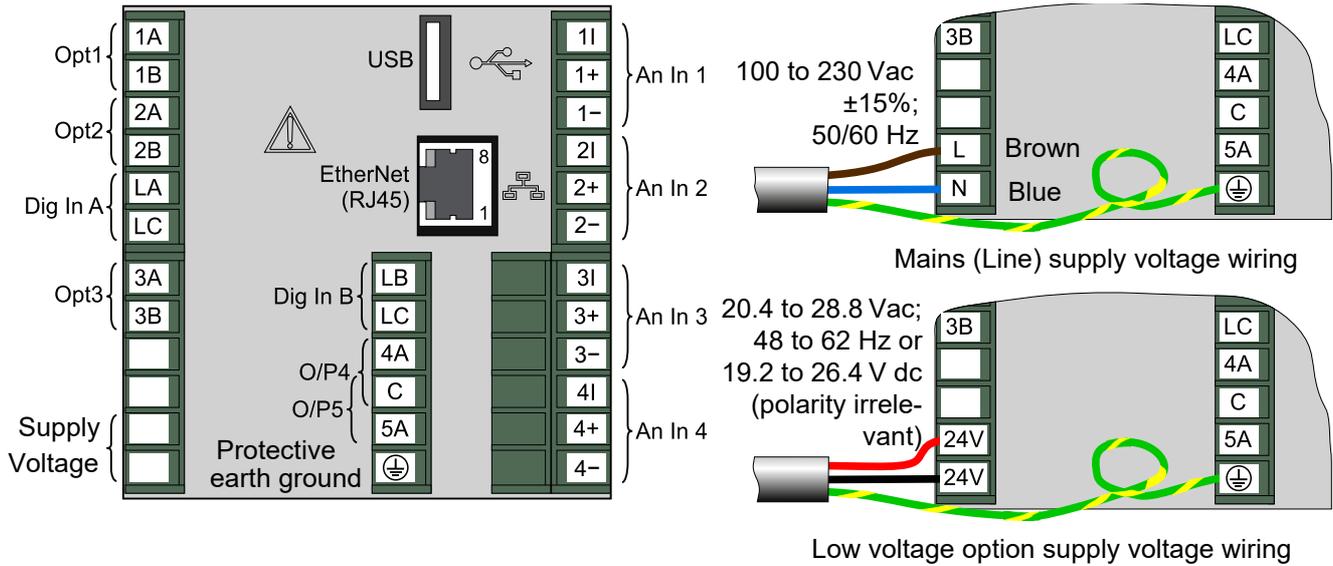
Electrical installation

The illustration overleaf shows the locations of the various user terminations along with signal and supply wiring pin-outs.

Termination details

The screw terminals accept single wires in the range 0.21 to 2.08 mm² (24 to 14 AWG) inclusive, or two wires each in the range 0.21 to 1.31 mm² (24 to 16 AWG) inclusive.

Screw terminals should be tightened to a torque between 0.4 N·m (3.54 lb·in) and 0.5 N·m (4.43 lb·in)



For thermocouples use the correct type of compensating cable and maintain polarity throughout.
 For milliamp input, this must be configured as a voltage input with an ohms law calculation in the strategy to convert to current.
 For other connections use conductors only.
 The power supply input is not fuse protected. This should be provided externally

Figure 3: Connector locations and pin-outs (rear panel)

Low Voltage Option

This option allows the use of a low voltage ac or dc 24 V supply. The "Technical Specification" on page 43 gives full details. The polarity of the dc supply connection is not important—it may be connected either way round.

Operation

What's in this chapter

This chapter provides an overview of how to operate the E+PLC 100, using the Default Application as an example.

Start up

When the instrument is initialising a splash screen is displayed.

This is followed by a white screen for up to 10 seconds, followed by the visualisation that forms part of the CODESYS application.

New instruments are pre-loaded with a default application which may be used to provide an introduction to the instrument features and a method of setting the network configuration and time/date.



NOTICE
A typical start up time for the instrument is about 90 seconds. Large applications may take longer to load but the majority (90–95%) of the typical start up time is for instrument initialisation.

WARNING
LIVE SENSORS The default application must be removed when the user application is installed. Removing an application does NOT default the network settings, nor the time/date. Therefore, if users do not require these to be changed again, then the user application does not have to include mechanisms to change them. If, however, network settings, and time/date may need to be changed in the future, the user application must include a method of setting them. When removing an application please refer to "Configure" on page 23 for instructions.

The first time you connect to the instrument using the E+PLC software (CODESYS Development System) you will have to enter an Administrator password for the device.

Note: Ensure the strong password you create can be memorized and entered correctly, as the device will be inaccessible and remain non-connectible without the Administrator password.

For further information see;

- "Accessing the CODESYS Online Help" on page 39
- CODESYS Online Help > Home > Setting up E+PLC100 hardware > Initial connection & connecting to E+PLC100

Introduction to the Default Application

The default application opens a 'home' screen which provides navigation to four page headers via the f1 to f4 touch sensitive buttons.

The default application is available from the E+PLC installed location, typically

C:\Program

Files (x86)\Eurotherm\E+PLC "Version NN"\E+PLC100\DefaultApplication.



f1 = **demo**. This allows access to a simple demonstration application.

f2 = **configure**. This allows IP addresses and time and date settings to be configured.

f3 = **help**. This selects a help page.

f4 = **status**. This shows the state of analogue and digital I/O.

Note: f1 to f4 have different functions when other pages have been selected—generally as follows:

f1 Return to home page

f2 Continuous scroll around the four header pages.

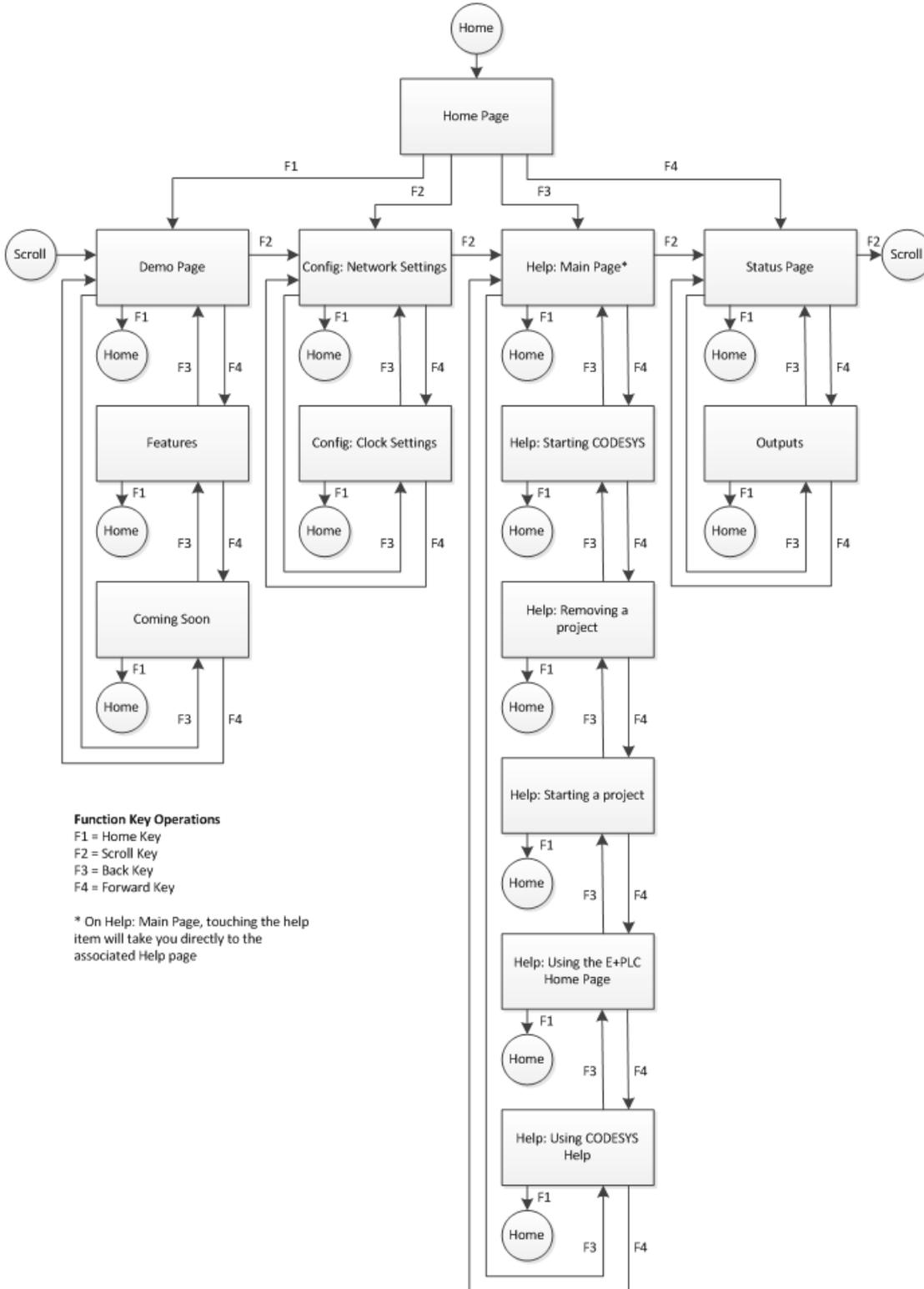
f3 'back' function

f4 'forward' function

Please refer to the section "Navigation Diagram" on page 21.

Navigation Diagram

The function buttons are used to navigate around the display as shown in the diagram below:-



Function Key Operations

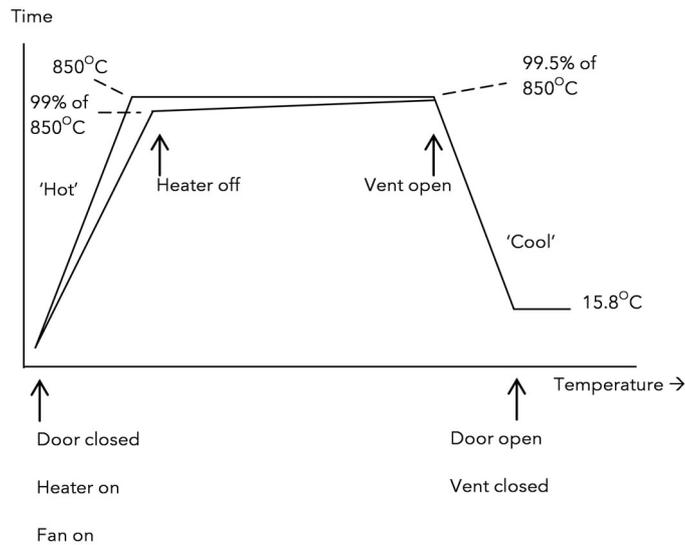
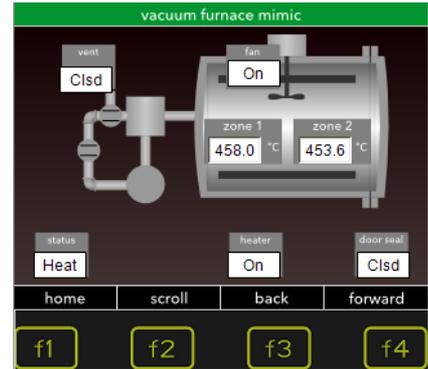
- F1 = Home Key
- F2 = Scroll Key
- F3 = Back Key
- F4 = Forward Key

* On Help: Main Page, touching the help item will take you directly to the associated Help page

Demo

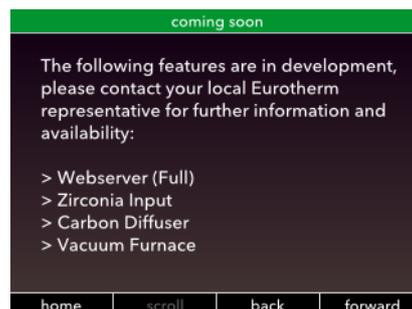
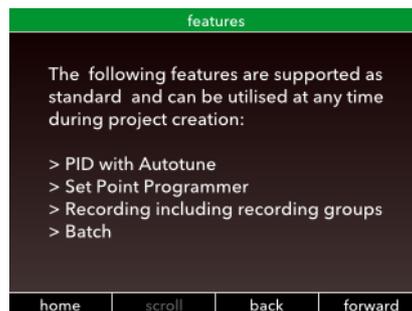
This page shows a mimic of a hypothetical vacuum furnace which performs a simple ramp/dwell temperature sequence.

The two temperature zones follow a ramp up, dwell and ramp down sequence with events occurring at specific times. These events are displayed in the message boxes as the sequence progresses.



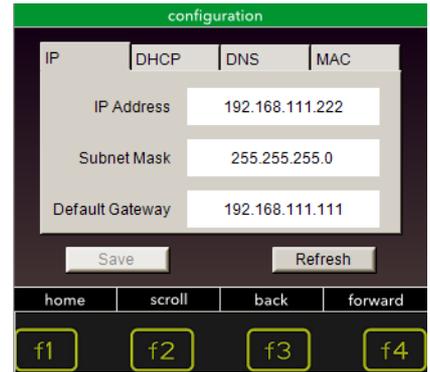
Features

Press **f4** 'forward' to display a list of features followed by those in current development



Configure

Configuration pages allow the network settings and time/date to be set up.



Setting the IP address

Click into the IP address to set. The 'number' pad appears. Enter the required address and 'accept'.

'escape' closes the number pad and 'clear' returns to the previously entered address

7	8	9	Max:
4	5	6	
1	2	3	Min:
.	0	+/-	
back	clear	escape	accept

The same procedure is followed for the Subnet Mask and Default Gateway.

NOTICE	
The addresses cannot be changed if a contact is made between terminals LA and LC (Dig In 1) . This is to protect against unauthorised changes.	

Please refer to the Warning note on page 19 if the demonstration is removed and replaced by the user program.

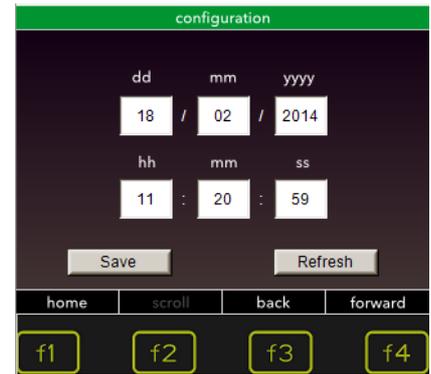
Also from this page access to further methods of setting the address is possible:-

- DHCP
- DNS
- MAC address. This is read only

Setting the time and date

From the configuration page, press **f4** (**forward**)

Click into the setting to access the number pad and enter the correct time followed by date.



The screenshot shows a configuration page titled "configuration" with a dark background. It features two rows of input fields for date and time. The first row is for the date, with labels "dd", "mm", and "yyyy" above the fields. The second row is for the time, with labels "hh", "mm", and "ss" above the fields. Below the input fields are two buttons: "Save" and "Refresh". At the bottom of the screen, there is a navigation bar with four buttons: "home", "scroll", "back", and "forward". Below the navigation bar, there are four function keys labeled "f1", "f2", "f3", and "f4", each enclosed in a yellow box.

dd	mm	yyyy
18	02	2014
hh	mm	ss
11	20	59

Save Refresh

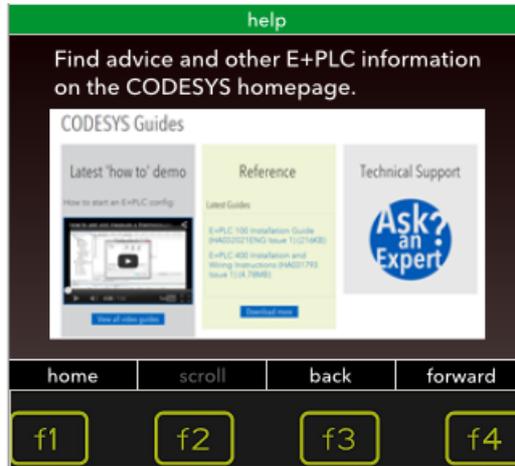
home scroll back forward

f1 f2 f3 f4

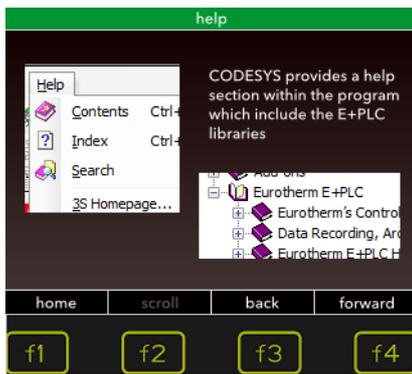
Help Pages

The 'help' page provides access to a number of screens as shown below:

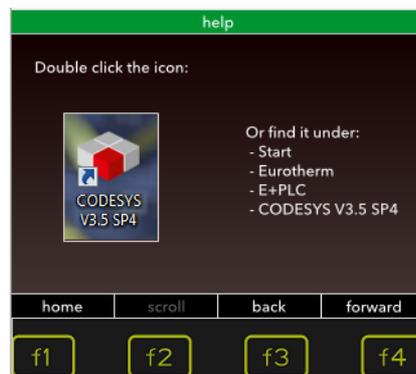
HOME Page



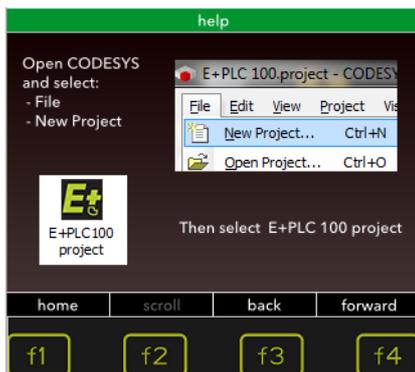
main page



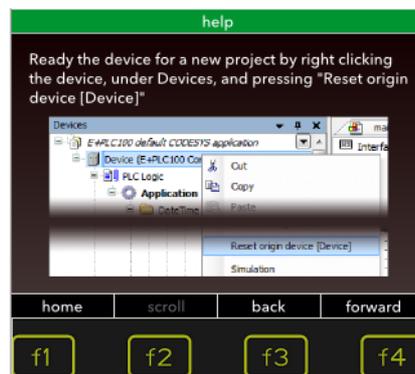
starting CODESYS



project page



reset page

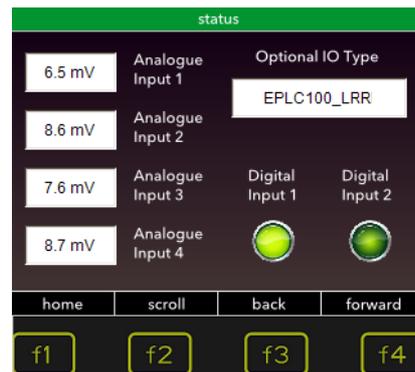


Status Page

This page shows the status of the I/O. The first page shows the status of the analogue and digital inputs.

The Digital Input 1 indicator can be turned on by closing the contact on terminals LA and LC (Dig In A).

The Digital Input 2 indicator can be turned on by closing the contact on terminals LB and LC (Dig In B).



Press **'forward'** to show the status of the relay outputs. To change the state of the relays touch the relevant button on the screen.



To Configure E+PLC 100 Input/Output

What's in this section

This section explains how to use the CODESYS Integrated Development Environment to configure the E+PLC 100 I/O.

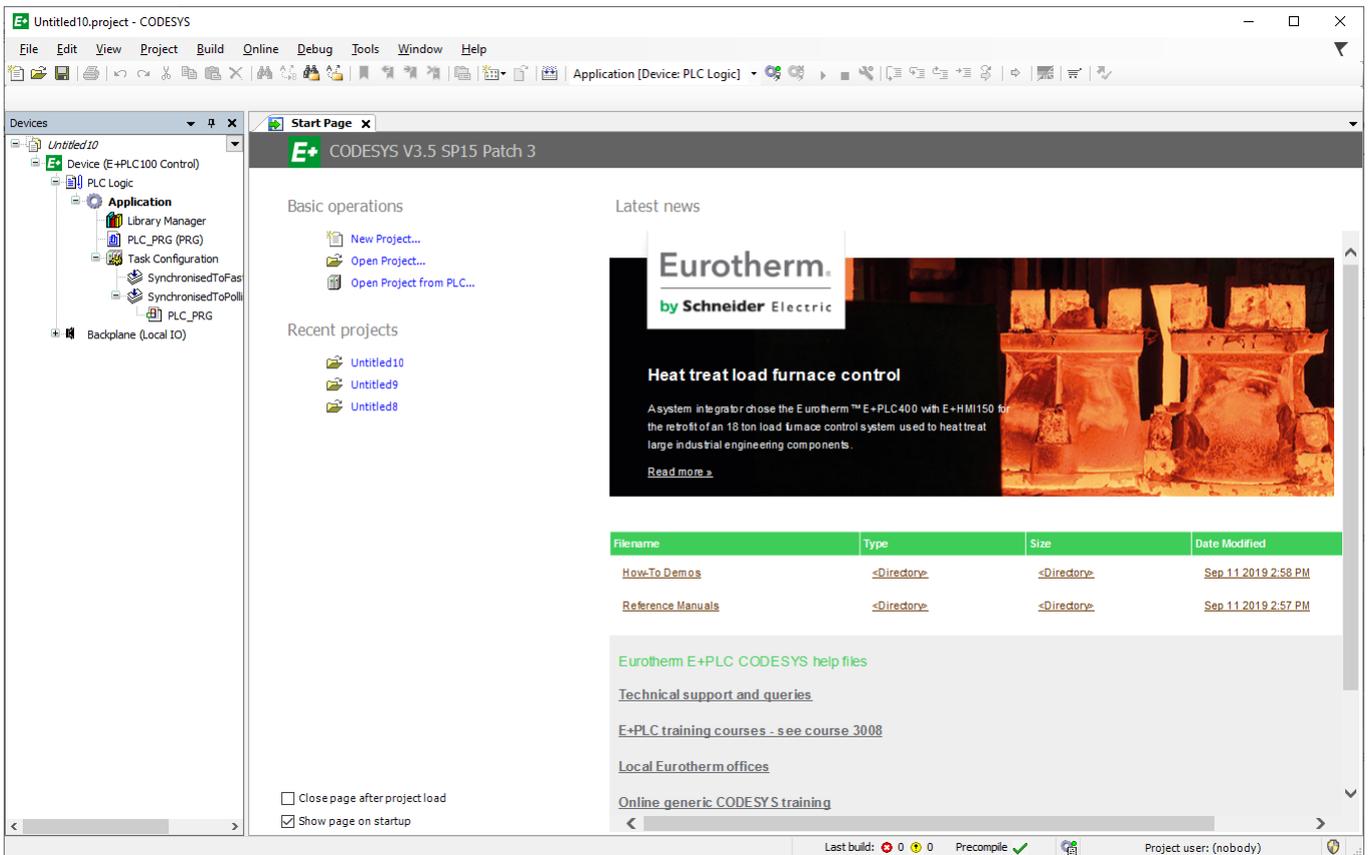
The E+PLC100 is configured and monitored using the E+PLC software which includes the CODESYS Development System, running on a PC (*Windows 8 / 10, 32/64 Bit*. The versions maintained by Microsoft are supported).

Connect to a Device

Connect the E+PLC100 to a PC running the CODESYS software using the Ethernet connection. For further information see;

- "Accessing the CODESYS Online Help" on page 39
- CODESYS Online Help > Home > Setting up E+PLC100 hardware > Initial connection & connecting to E+PLC100
- 'How to' videos. These can be accessed through the web portal on the Start page displayed when CODESYS is first launched.

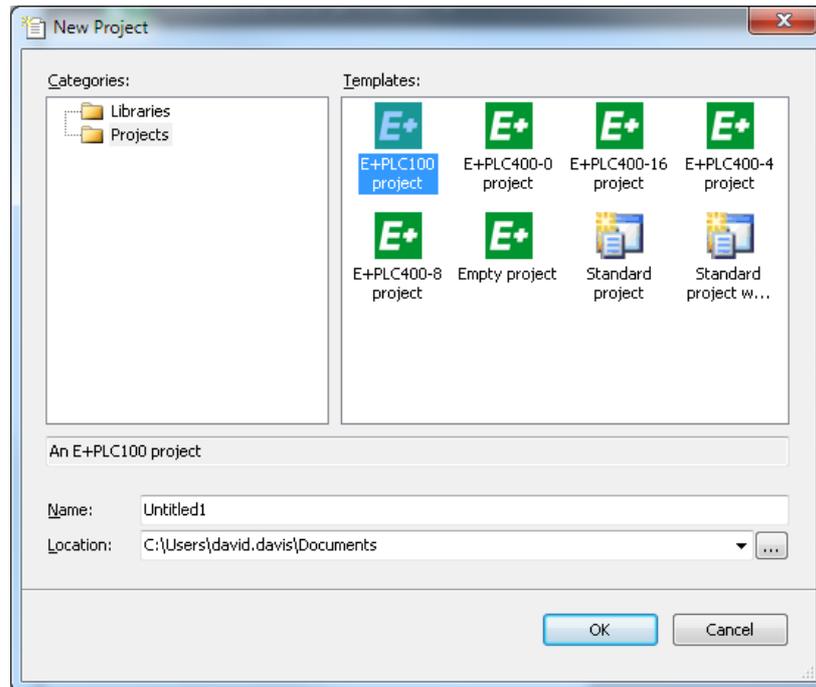
1. Open the CODESYS software



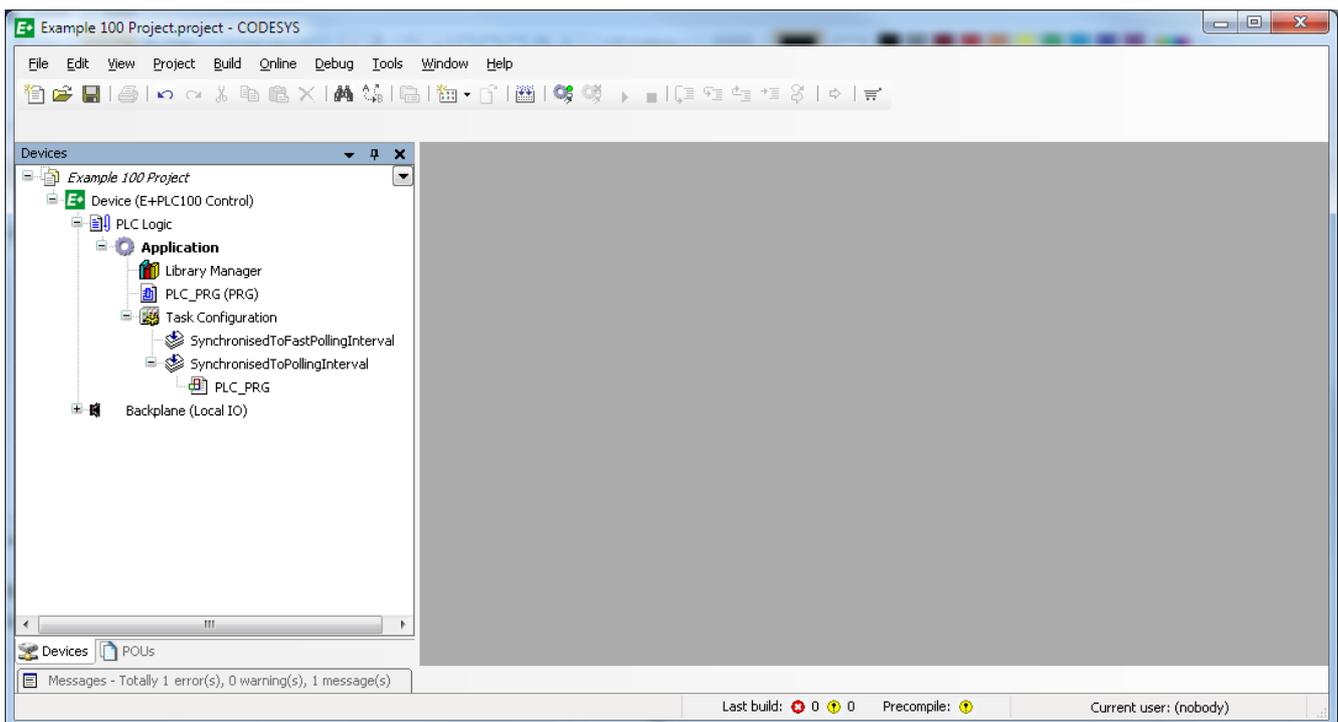
If the 'CODESYS Guides' section is not shown when first opened, select **View > Start Page**.

In the section **Latest News** a list of sample applications may be found.

2. New Project: Select New Project and give it a name, e.g. Application1.

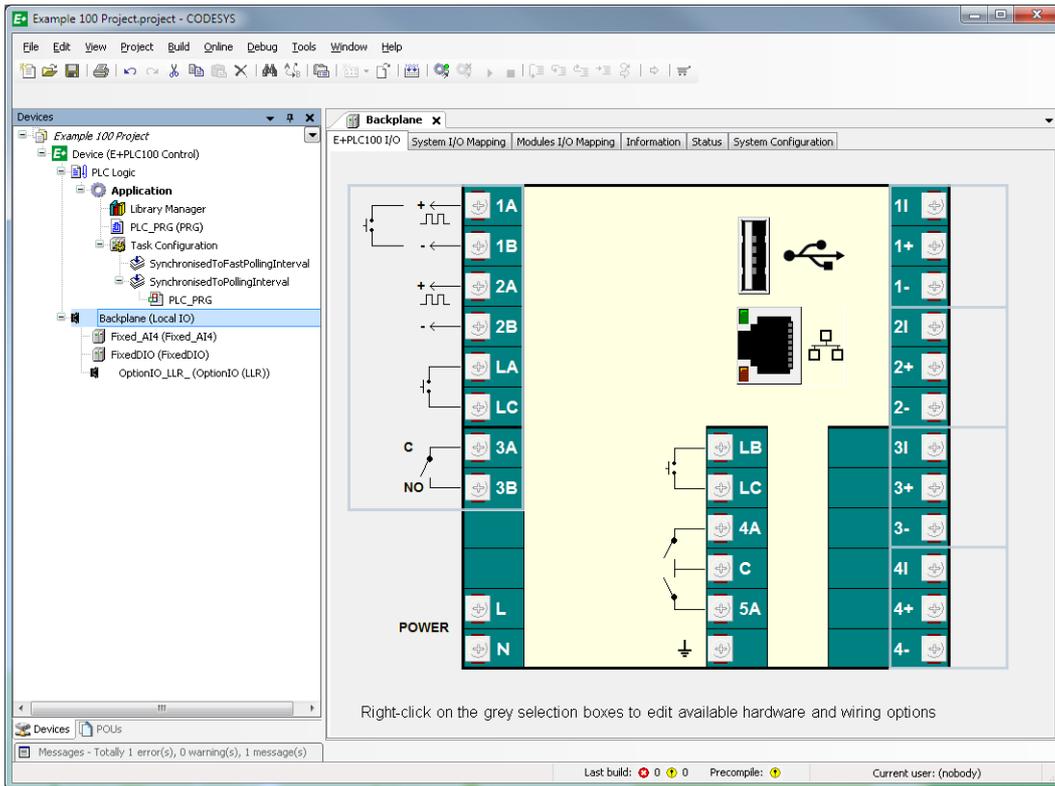


3. Select E+PLC100 project



There is more than one way to define the I/O, but the most convenient may be to show it graphically using a view of the rear terminals.

4. Double click **Backplane (Local IO)**



A view of the terminal block is shown. Click in any of the grey selection boxes to show a list of available input or output types. The list of available I/O is opened under the **Backplane** folder.

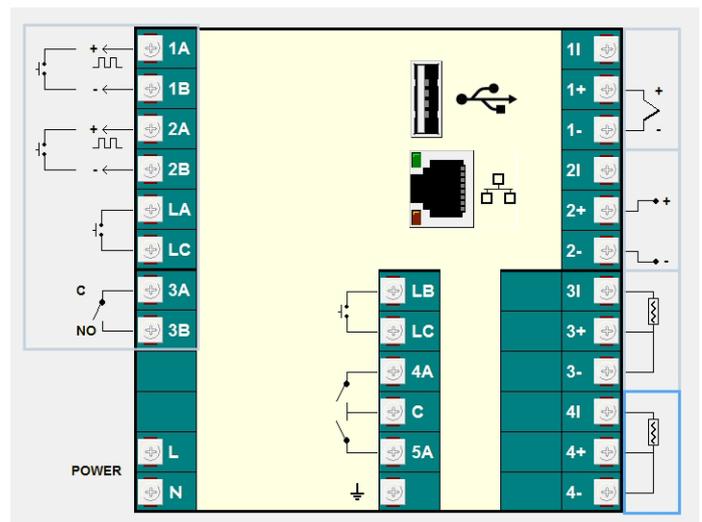
To select Analogue Input type

Right click into the grey selection box next to the input to be configured, for example, the 1I, 1+, 1- terminals (Input 1).

Select the input type from:

- Off
- -40mV to +40mV
- -80mV to +80mV
- -3V to +10V
- -2V to +2V
- 3-Wire, 0 to 400 Ω (Platinum resistance thermometer, PRT)
- Thermocouple -40mV to +40mV
- Thermocouple -80mV to +80mV

Repeat for all four inputs.



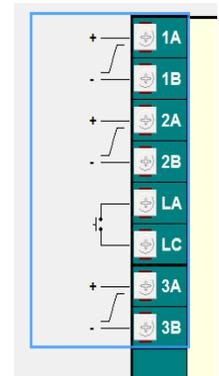
A diagrammatic representation of the I/O type is shown connected to the relevant terminal. Note that terminals with an I suffix (capital letter 'i') act as a current source for resistance measurements. In the example shown:

- Input 1 is a thermocouple/
- Input 2 is mV or V.
- Input 3 is configured as a 3-wire RTD. The physical input can be a 2-wire RTD by wiring it between 3I and 3+ with a link placed between 3+ and 3-.
- Input 4 is a 3-wire PRT.

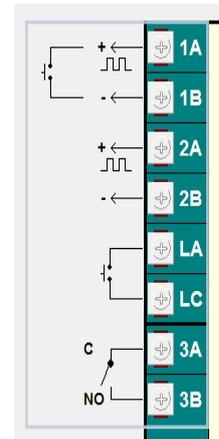
To select Option I/O type

Click in the grey selection box next to the option I/O terminals. The choices are:

OptionIO (DDD) Choose this option if the hardware of your device contains: Isolated DC O/P on Opt1, Opt2 and Opt3

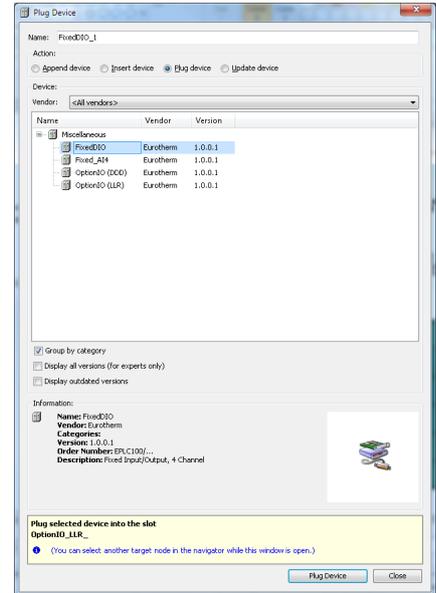


OptionIO (LLR) Choose this option if the hardware of your device contains: Opt1 = Logic input or output; Opt2 = Logic output only; Opt3 = normally open relay



Plug Device

This option in E+PLC100 is included for future development. In this release the above options are duplicated.



FixedDIO

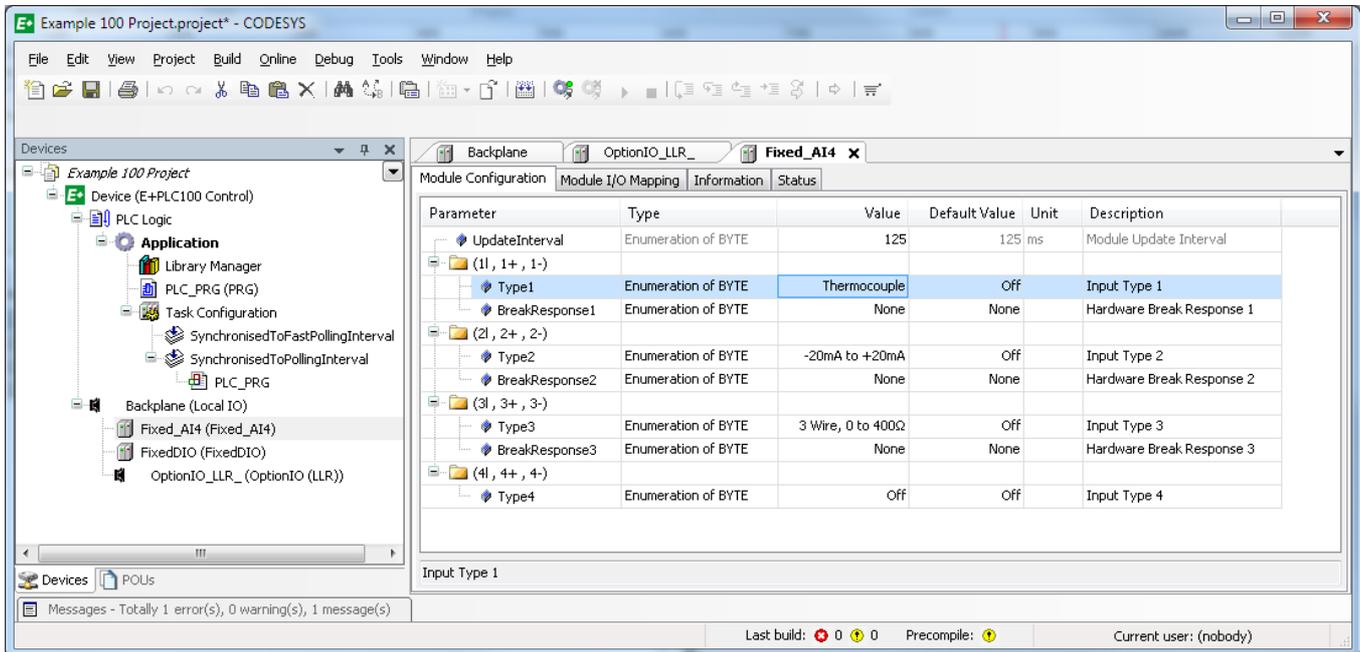
Not applicable to the current release

Fixed_AI4

Not applicable to the current release

Module Configuration Tab

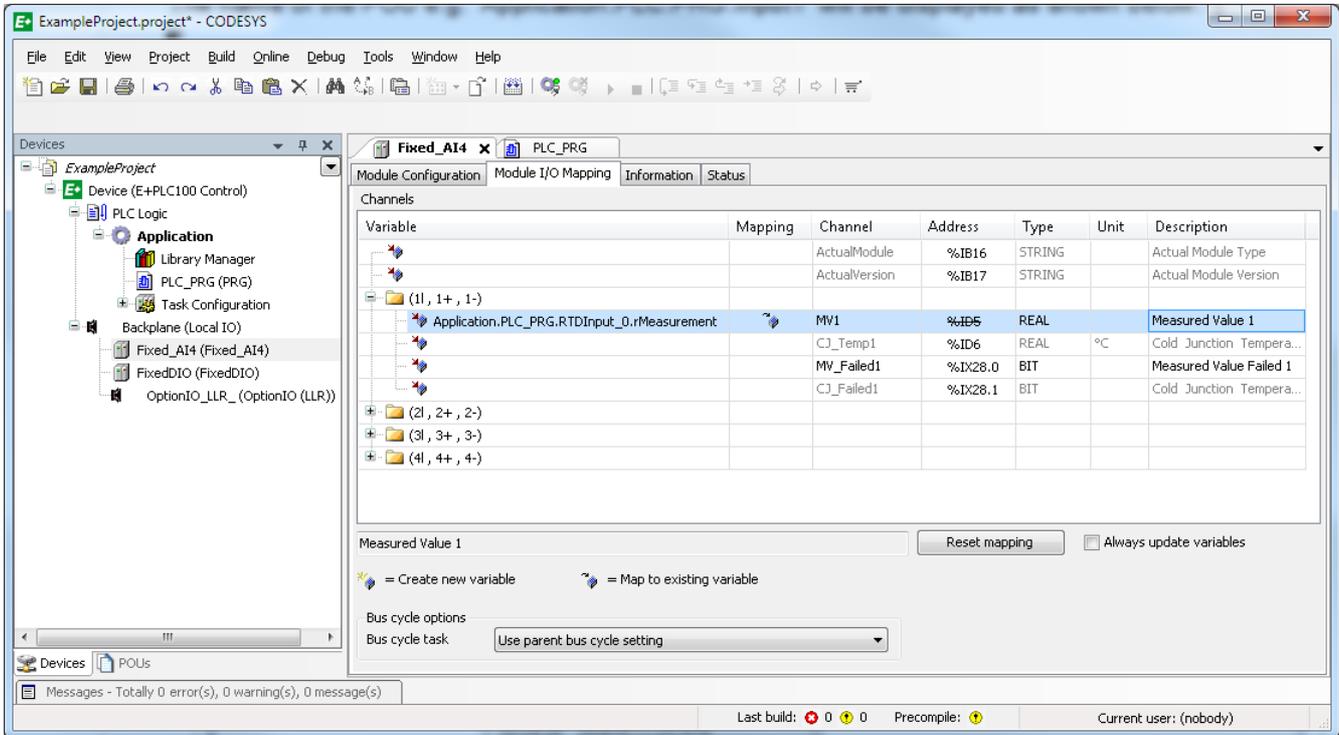
Double click the path 'Fixed_AI4'. In the tab 'Module Configuration' a list of the analogue I/O is given.



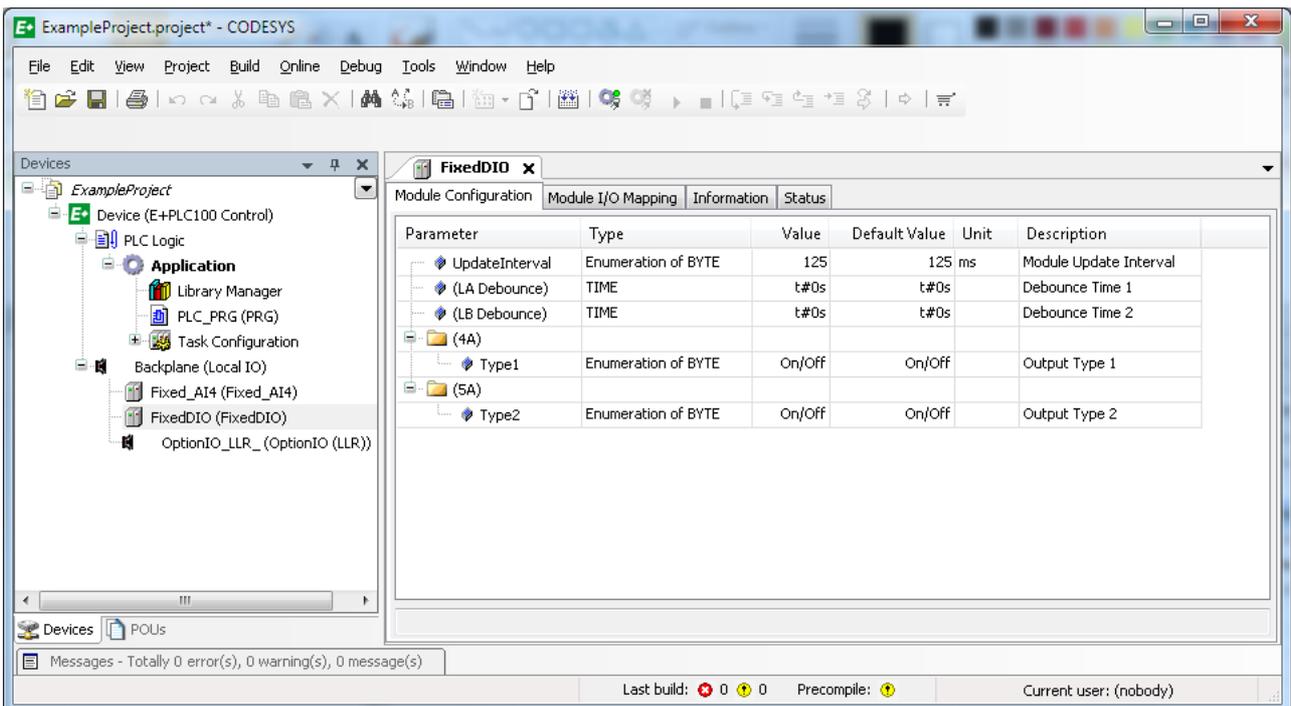
The I/O can also be configured from this menu as an alternative to the backplane view

Module I/O Mapping Tab

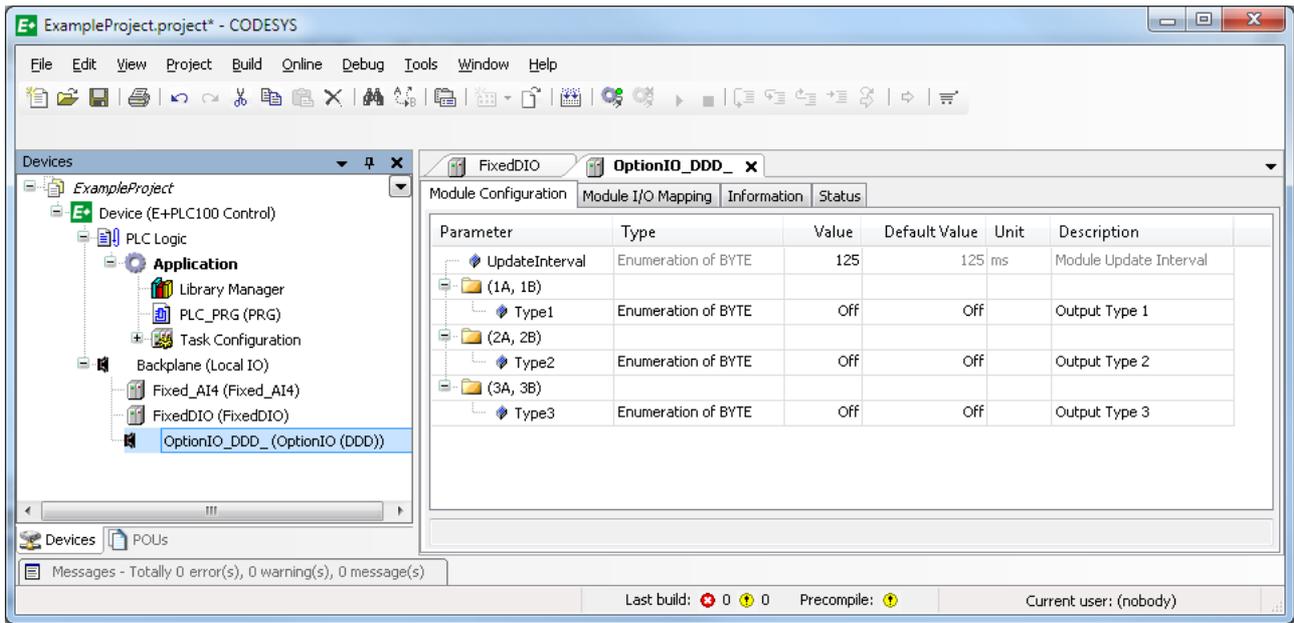
The tab **Module I/O Mapping** shows the parameters associated with the I/O type. It also allows the source of the parameter to be defined. For example, to wire the container to physical input, double click in the **Variable** column of the MV1 line. Provided that an application has been created (i.e. an input or output container has been defined as explained in "Wiring" on page 35.) then, using the ellipsis, find the variable you want and double click. The name of the POU will be displayed as shown below.



Similarly, double click the path 'FixedDIO' to show the Module Configuration of the Fixed IO.



Or 'OptionIO' to show the Module Configuration of the variable IO



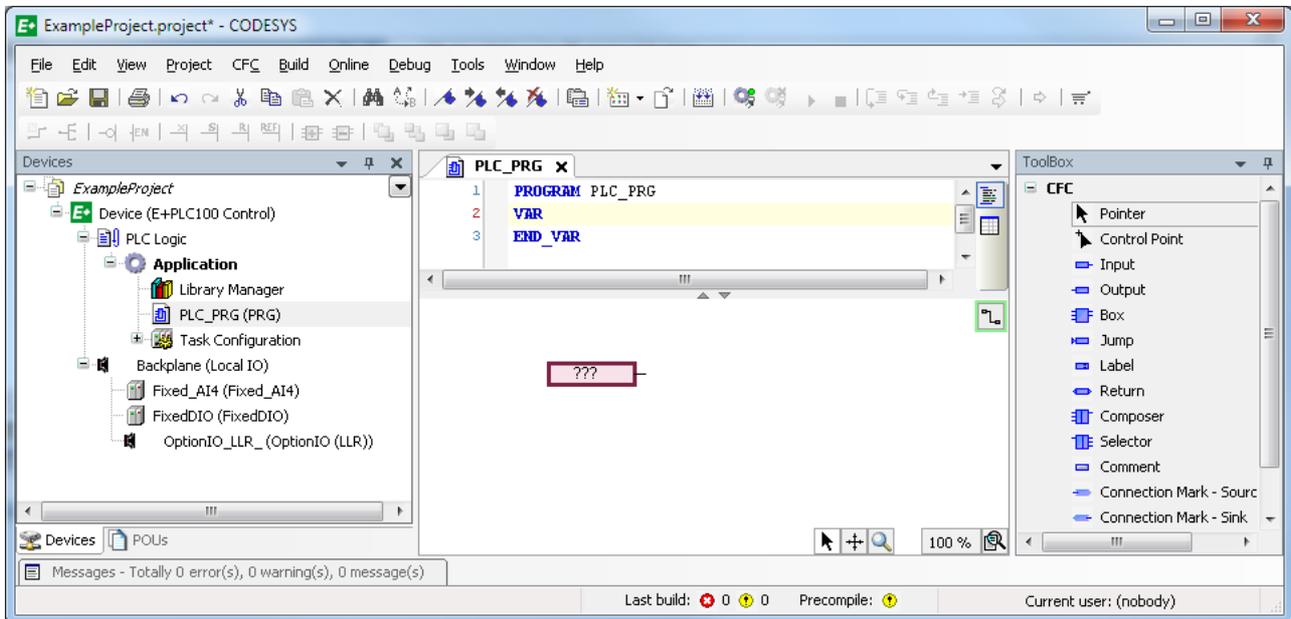
Introduction to Producing a Strategy

This section is intended as a very basic introduction to produce a real application.

Double click the tab 'PLC_PRG'.

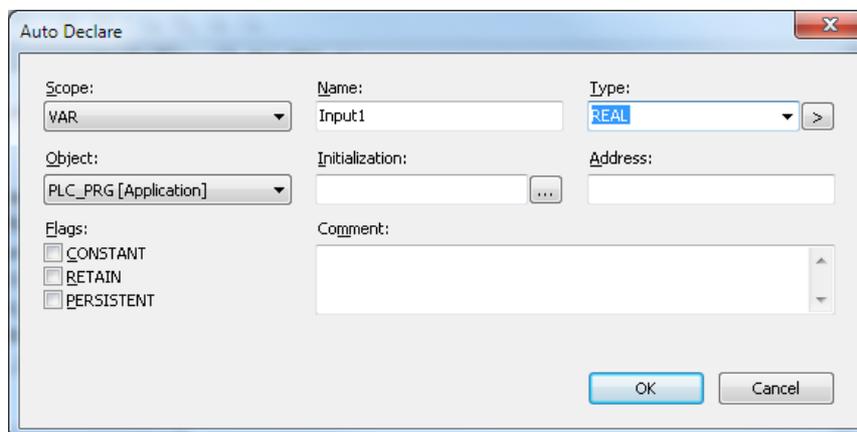
Example: To produce a 'container' for analogue input 1.

Drag an 'Input' from the ToolBox on the right hand side. This box is a container for a variable.



Type in a name e.g. **Input1**.

When enter is pressed the **Auto Declare** pop up is displayed.



Select the **Type** from the drop down. In this example the type is a REAL value.

The flags **CONSTANT**, **RETAIN** and **PERSISTANT** are defined in the CODESYS Help. Note that RETAIN and PERSISTANT data is stored in an FRAM device, periodically (typically every 10 s).

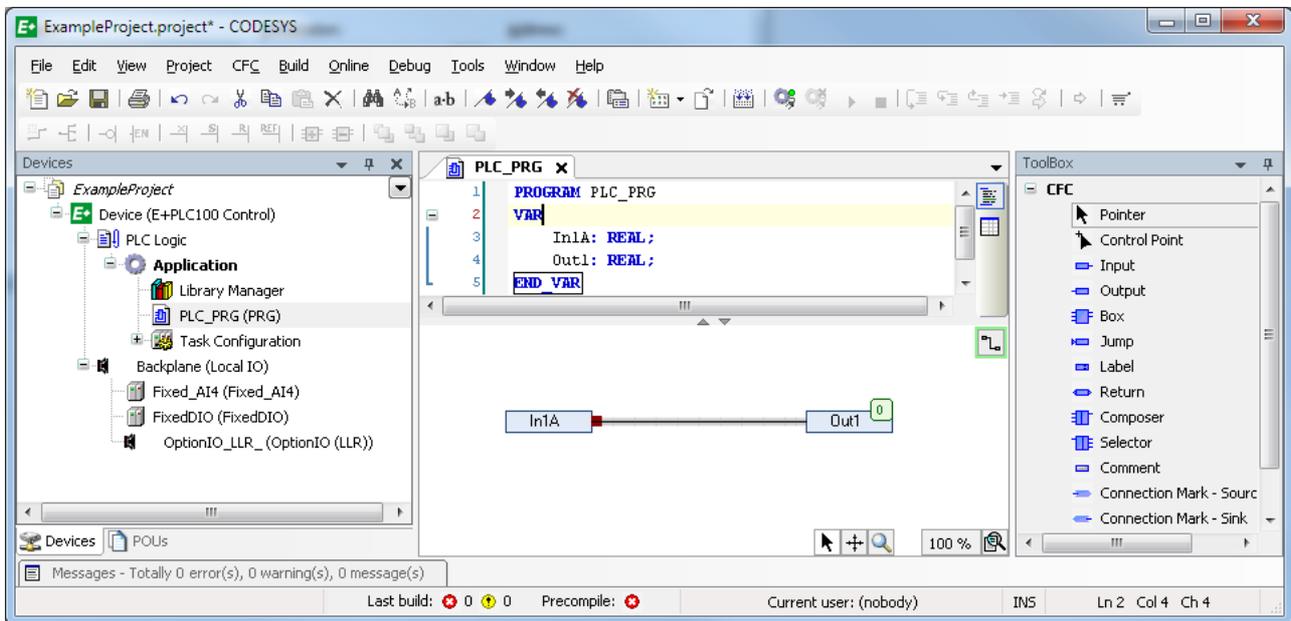
When the block has been entered it will appear under the **VAR** list.

Wiring

Example: To connect the Input to an Output container so that its value appears in the output container.

Drag and drop an 'Output' from the ToolBox and configure it in the same way as shown for Input1.

Click on either the input or output and drag a wire from one to the other.

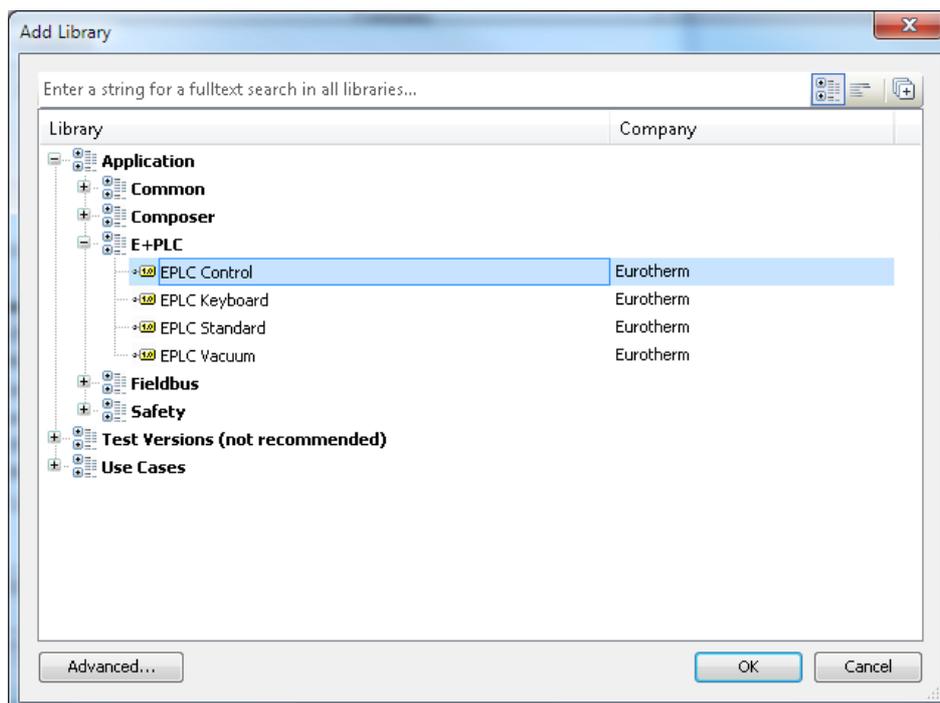


To Add a PID Control Block

A further strategy can be built using the items from the **ToolBox**.

The ToolBox contains a list of commonly used function blocks.

If the required block is not present it can be added from the library. For example, to add a control block, select **Library Manager** from the list. Click **Add library** and **Select EPLC Control** and **OK**.



Example 1: To wire Input1 to the PID loop

Drag a 'Box' from the ToolBox. Name the box eg PID — a drop down is shown when you begin typing. When the block is declared it will appear in the VAR list.

Add a wire from the output of 'Input1' to the applicable input parameter of the PID block, e.g. the PV input 'rPV'.

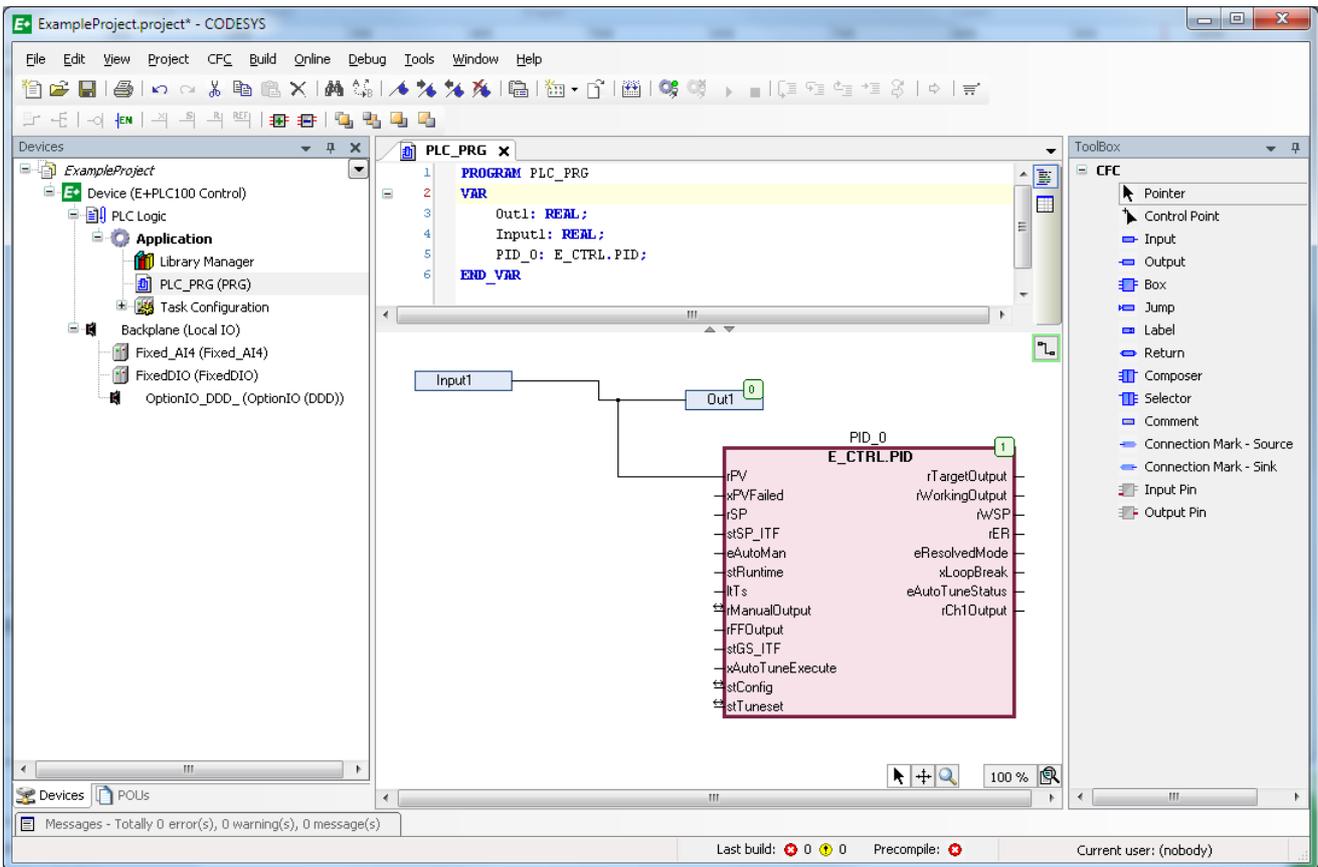
Note the prefix:

r means a reference source.

x is a boolean

e is an enumeration

rr is a reference source the value of which can be overridden depending upon the strategy. For example, a three term value may be overridden by auto tune



NOTICE

To reduce the number of I/O parameters, right click the block, select **Pins** and **Remove Unused pins**.

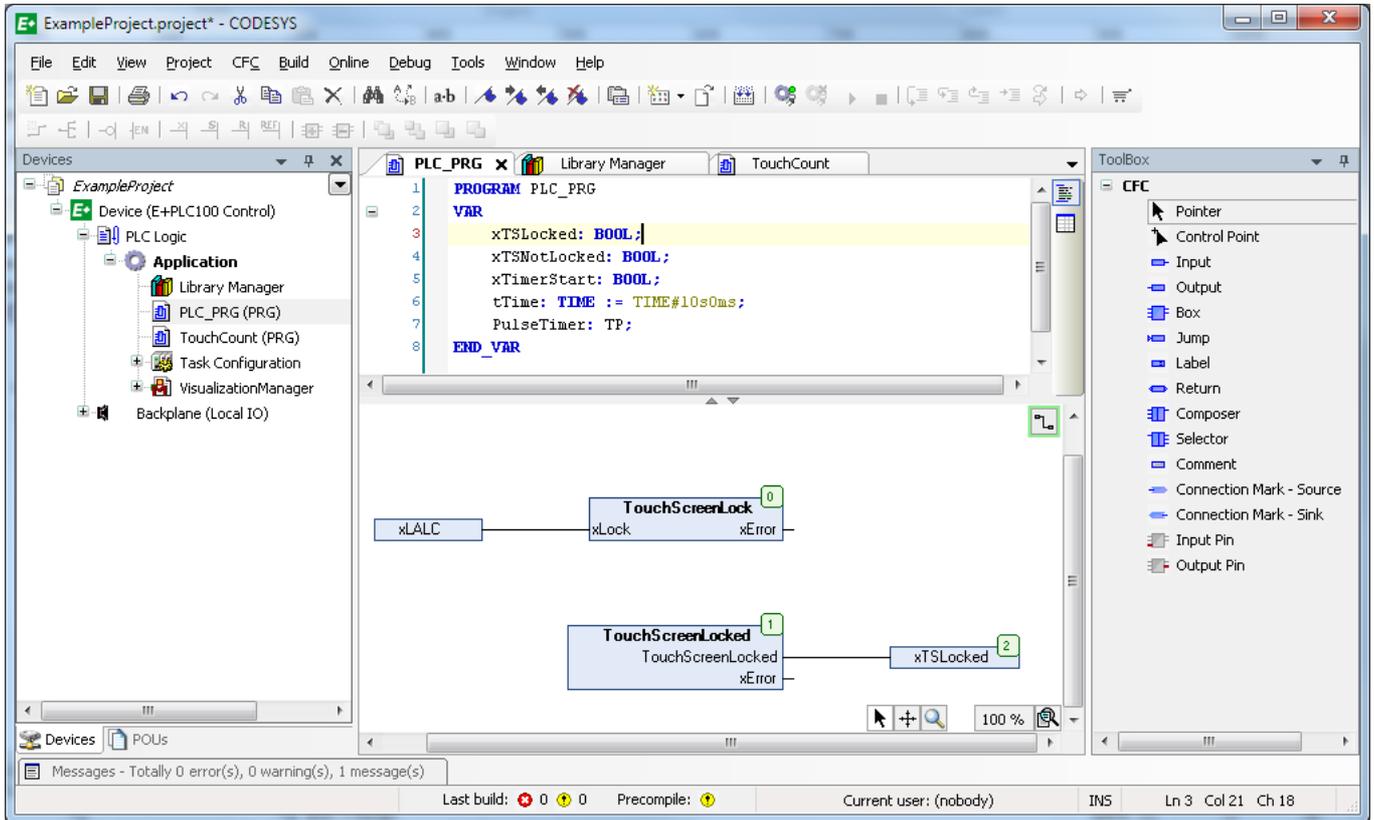
When complete select **Build** from the menu.

Further information is available by accessing the **Help** library.

Example 2: Touch Screen Lock

A function block specific to E+PLC100 allows the touch screen to be locked. The strategy shown in the screen shot below shows the touch screen locked by a digital input being activated. The strategy could be expanded using inputs such as a timer to start a timed delay, for example.

A confirmation of the lock is produced by the function block TouchScreenLocked shown below connected to a digital output but which could equally produce a screen message or other functions.



To produce the TouchScreenLock function block, Drag a 'Box' to the screen. Begin to type 'E_SL' (Eurotherm Screen Lock) and select this from the pop up. Then begin to type '.' and select 'TouchScreenLock'.

The 'TouchScreenLocked' confirmation function block is similarly produced.

These blocks are shown wired to Input and Output blocks as in the previous example.

Alternatively, it may be found more convenient to add the EPLC Screen Lock library from the Library Manager. The procedure is described in "To Add a PID Control Block" on page 35.

Loading a new application

What's in this section

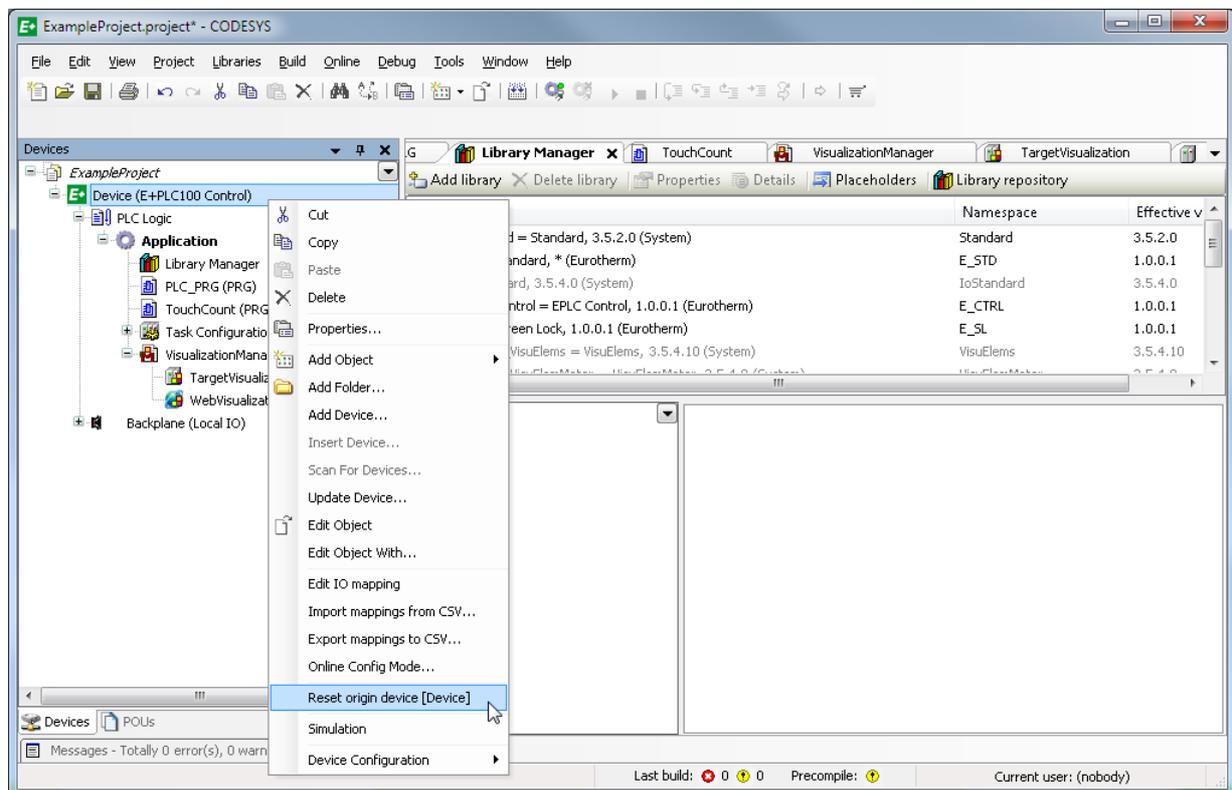
This section explains how to load a new application onto the E+PLC 100

As stated in "Operation" on page 19 it is necessary to clear the demonstration or any other application before loading a new one. The method for doing this is to perform a **'Reset origin device'** operation in the CODESYS software. This is accessed from the CODESYS Development System file manager.

For further information see;

- "Accessing the CODESYS Online Help" on page 32
- CODESYS Online Help > Home > General Topics > Recovery Procedures
- CODESYS Online Help > Home > General Topics > Recovery Procedures > Restore non-responsive Device.

This will remove all application specific files, including the visualisation images.



NOTICE

In the current release it is not possible to access the application files via the CODESYS Development System file manager.

Accessing the CODESYS Online Help

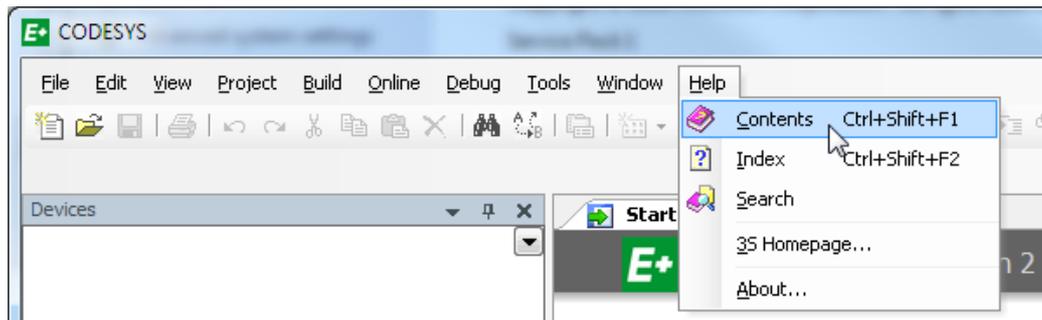
What's in this section

This section explains how to access the help in the CODESYS Integrated Development Environment.

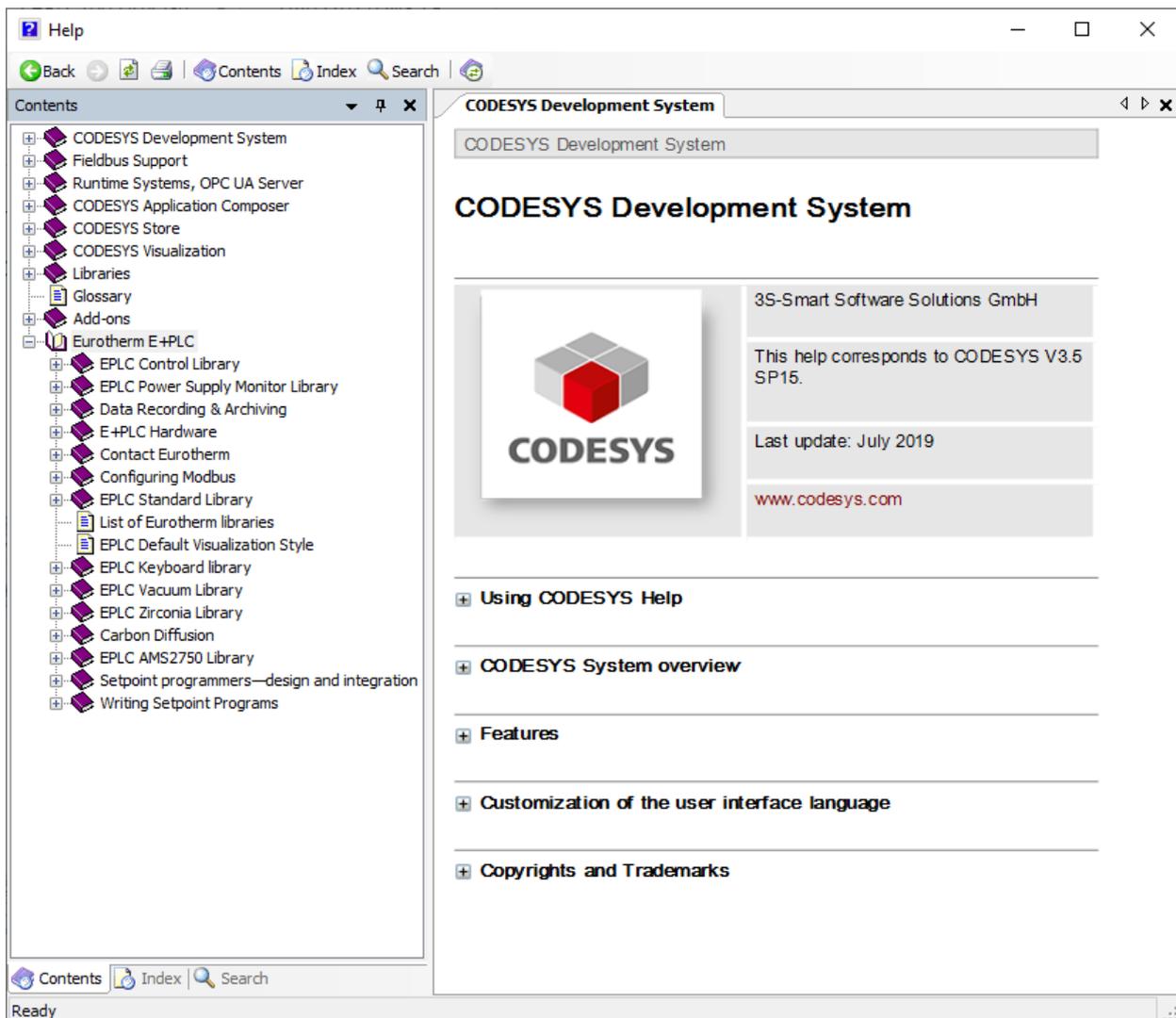
Online Help

The CODESYS software includes extensive online help.

To launch the CODESYS help, click on its **Help** menu:

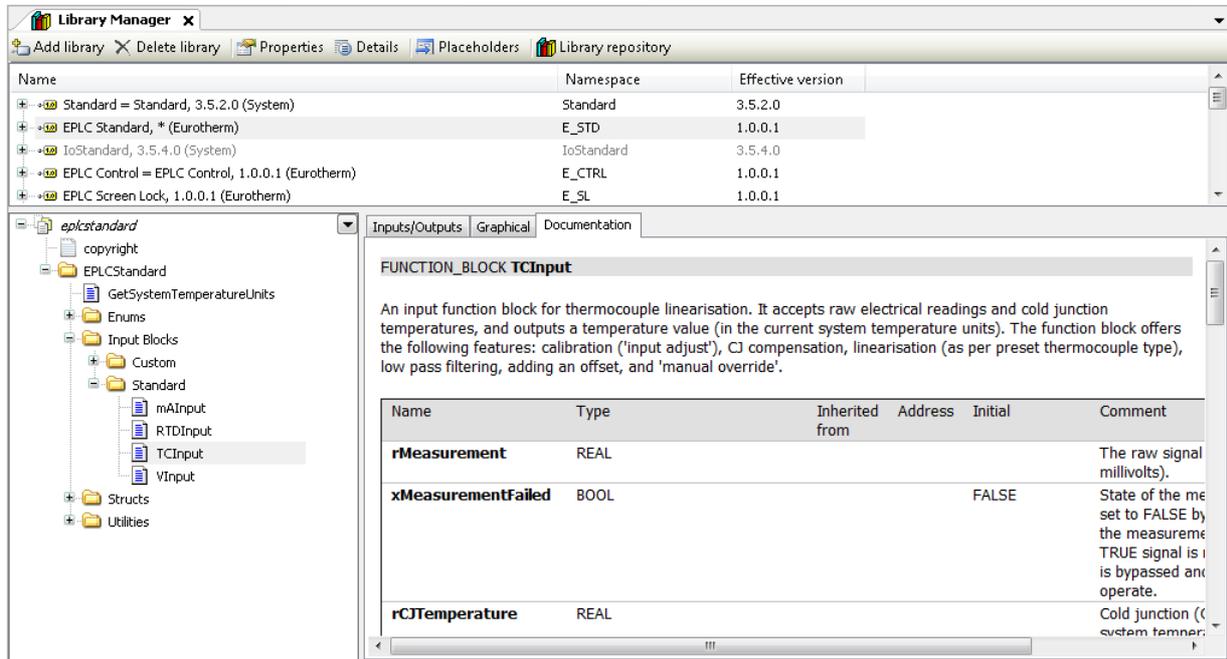


The **Online Help** window is displayed.



CODESYS Library Documentation

In addition to the CODESYS Online help, CODESYS libraries include their own documentation, with detailed information on the POU (Program Organisation Units) in the library (such as functions and function blocks). These can be viewed in the CODESYS editor windows themselves, for example, in the Library Manager shown below.



A subset of the same information is also displayed in a tooltip when using the mouse to hover over POU.

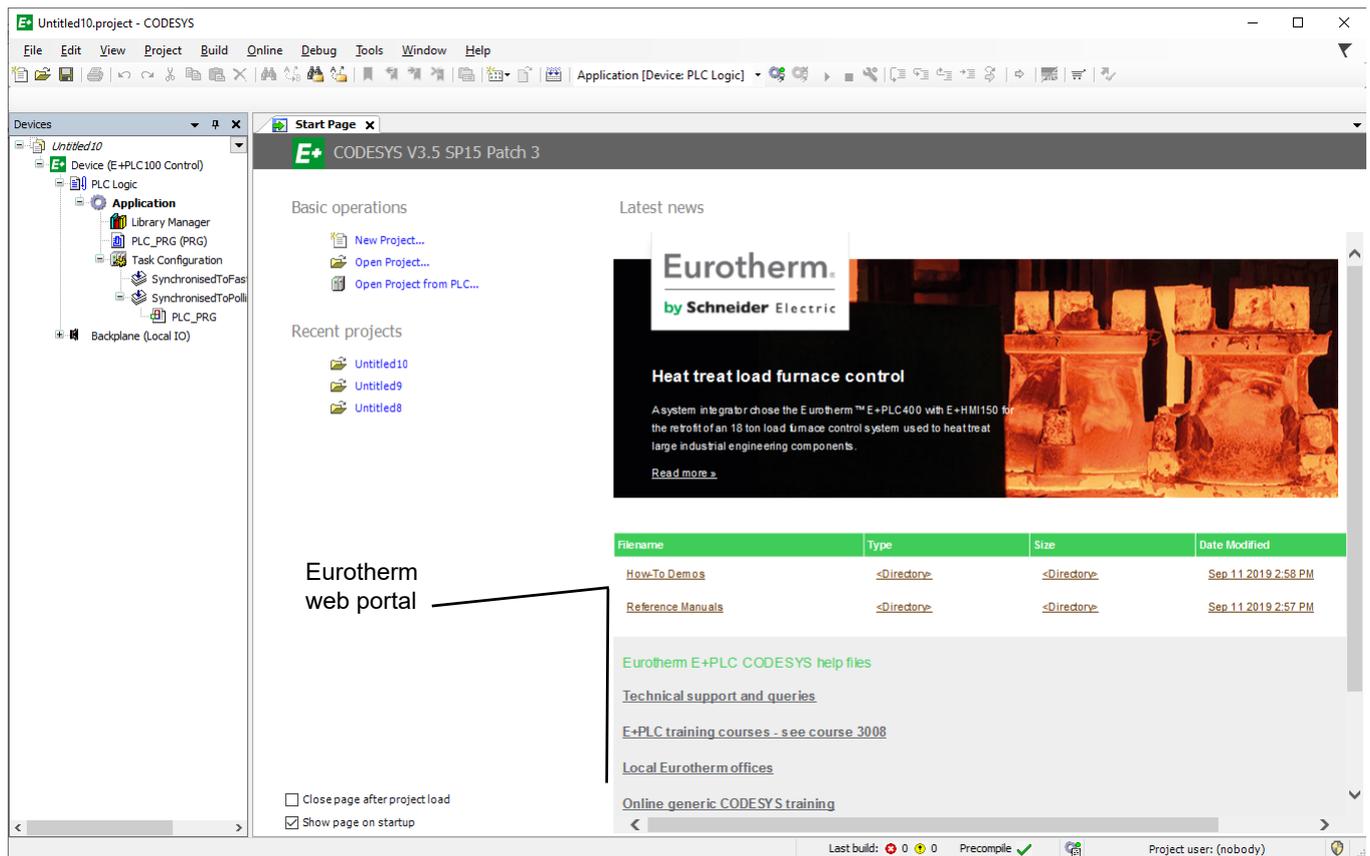
To display information on a POU in the Online Help window, select the POU and press **F1**.

Online tutorials and 'How to' videos

A range of online tutorials and 'How to' videos for the E+PLC 100 are available. These can be accessed through the web portal on the Start page displayed when CODESYS is first launched.

NOTICE

To access the online tutorials, the PC running the CODESYS software must have internet access.



Additional Notes

Modbus Communications - Setting up projects for Modbus

NOTICE

To enable Modbus slave communications on an E+PLC device, you must uncomment the line:

```
pass in on emac0 proto tcp from any to any port = 502
```

In the firewall configuration file which can be found on the device's file-system at /Firewall/fw4.cfg and can be restricted to specific IP or MAC addresses. Changes to the firewall will not take effect until the instrument is power-cycled.

Encrypted Communications

CAUTION

Encrypted Comms (communications), which is set to ON by default (for phase 4) should be used and remain ON to help provide additional security through the use of encryption and minimize exploitation of known common vulnerabilities

WebVisu - Security Requirements

CAUTION

When using the WebVisu functionality on the E+PLC device, ensure both security methods User Authentication and Https are used.

Eurotherm Visualization Extension

NOTICE

The CODESYS HMI software package does not support some Eurotherm visualization components and will not display them correctly. Therefore it is not recommended to use the Eurotherm visualization library components with the CODESYS HMI software package.

Firmware update - Modbus slave settings

CAUTION

When applying a Firmware update to an E+PLC device using a Modbus slave function, it possible that the serial port settings may be cleared. Before commencing any update it is recommended that both the project should be backed up and any Modbus slave settings recorded.

Technical Specification

What's in this section

For reference purposes, this section lists technical specifications for the E+PLC 100.

General

I/O types

Analogue inputs	Four
Digital inputs	Three maximum (dependent on option board)
Digital (logic) outputs:	Two maximum (dependent on option board)
Relay outputs:	Three maximum (dependent on option board)
DC outputs:	Two maximum (dependent on option board)

Network communications

Ethernet:	10/100 BASE-T Ethernet (IEEE802.3)
Protocols:	Modbus TCP/IP master/slave
Cable type:	Category 5
Maximum length:	100 metres (110 yards)
Termination:	RJ45
LEDs:	Green LED illuminated = link connected; Amber LED flashing shows link activity

USB

Number of ports:	one at rear of instrument
Standard:	USB 1.1
Transmission speeds:	1.5 Mbits/s (low speed device)
Maximum current:	< 100 mA
Peripherals supported:	Memory stick (8 GB max.), barcode scanner (US locale only), keyboard (US layout only)

HMI

Display:	3.5" TFT colour display (320 pixels wide × 240 pixels high), active touch screen size 320 × 288 pixels—refer to "Display and Active Touchscreen Dimensions" on page 51.
Controls:	Projected capacitive touchscreen; webserver

Memory resources

Application/visualisation files:	12 MB
Data Recording history files:	22 MB
Retain/Persistent data:	62 kB

File system

Max. filename length:	125 Unicode (UCS 16) characters
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Data Recording update/archiving

Sample rate (input/output):	8 Hz
Trend update:	10 Hz max.
Archive sample value:	Latest value at archive time
Display value:	Latest value at display update time

Real time clock (RTC) battery

Stored data:	Time, date
Replacement period:	Three years typical
Support time:	Minimum of 1 year with unit unpowered
Temperature stability:	0 to 55 °C ≤ +3.5ppm
RTC ageing:	First year to 10 year < ± 5ppm
Type:	Lithium polycarbonmonofluoride, Eurotherm part number PA260195

 CAUTION
RTC BATTERY: RISK OF EXPLOSION
Do not recharge, disassemble or dispose of the battery in fire.
Mistreating the battery in this way may cause it to explode.

Integrated Development Environment (IDE)

Software:	CODESYS IDE v3.5 with E+PLC packages
-----------	--------------------------------------

Power specifications

Supply voltage:	Standard 100 to 230 V ac ±15% at 48 to 62 Hz Low voltage: 24 V ac (+10% -15%) at 48 to 62 Hz, or 24 V dc (+20% -15%)
Power dissipation:	9 W max.
Fuse type:	No internal fuse fitted.
Interrupt protection:	Standard: Hold-up > 20 ms at 85 V RMS supply voltage Low voltage: Hold-up > 20 ms at 20.4 V RMS supply voltage

Environmental specifications

Ambient temperature range:	Operating: 0 to 55°C Storage: -20 to +70°C. Max. rate of change 1°C/min
Humidity range:	Operating: 5% to 85% RH non-condensing Storage: 5% to 85% RH non-condensing
Protection:	Front Panel: IP66, NEMA12 Rear Panel: IP10 (International)
Shock/vibration:	To BS EN61131-2: section 4.2.1 (5 to 150 Hz. at 2 g; 0.5 octave per min.)
Altitude:	< 2000 metres
Atmosphere:	Not suitable for use in explosive or corrosive atmospheres.

Electromagnetic compatibility

Emissions:	Standard units:	BS EN61326 Class B—Light industrial
	Low voltage option:	BS EN61326 Class A—Heavy industrial
Immunity:		BS EN61326 Industrial

Other approvals and compliance details

Regional:	Europe:	CE, RoHS, REACH, WEEE
	USA, Canada:	UL, cUL
	Russia:	EAC and Metrological Pattern Approval
	China:	RoHS. Not subject to CCC.
Industry-specific:	Nadcap:	suitable for use in furnace classes A–E as per AMS 2750E Section 3.
Packaging:		BS 61131-2:2007—Section 6.3.3 / 6.3.4.
Electrical safety:		BS EN61010-1 (Installation category II; Pollution degree 2)

Physical

Panel mounting:	¼ DIN
Weight:	0.44 kg (15.52 ozs) (instrument only)
Panel cut-out dimensions:	92 × 92 mm (both –0.0 +0.8) or 3.62 × 3.62" (both –0.00 +0.03")
Depth behind panel:	90 mm (3.54") excluding wiring

Fixed I/O

Analogue Inputs (An In 1–4)

General

Number of inputs:	Four
Input types:	dc volts, dc mV, dc mA, linear ohms, thermocouple, RTD (2-wire and 3-wire)
Input type mix:	freely configurable
Sample rate:	8 Hz (125 ms)
Conversion method:	16 bit delta sigma
Input ranges:	See Table 1 (dc volts, dc mV)
Mains rejection (48 to 62 Hz):	Series mode: > 95 dB Common mode: >179 dB
Voltage:	Series mode: 280 mV at lowest range; 5 V peak to peak at highest range Common mode: 250 V ac max.
Input impedance:	40 mV, 80 mV, 2 V ranges: > 100 MΩ 10 V range: input voltages > 5.6 V: 62.5 kΩ input voltages < 5.6 V: 667 kΩ
Overvoltage protection:	Continuous: ± 30 V RMS Transient (< 1 ms): ± 200 V pk–pk between terminals
Sensor break detection:	Type: ac sensor break on each input giving quick response with no associated dc deviations Recognition time: < 3 seconds Minimum break resistance: 40 mV & 80 mV ranges: 5 kΩ other ranges: 12.5 kΩ
Isolation:	Channel to channel: 300 V RMS or dc (double insulation) Channel to common electronics: 300 V RMS or dc (double insulation) Channel to ground: 300 V RMS or dc (single insulation)
Dielectric strength:	Test: BS EN61010, 1 minute type test Channel to channel: 2500 V ac Channel to ground: 1500 V ac

Table 1: An In 1–4 Voltage Input Ranges

Low Range	High Range	Resolution	Calibration accuracy (Instrument at 25°C)	Temperature Performance
-40 mV	+40 mV	1.9 μV	4.6 μV + 0.053% of reading	13 ppm of input per °C
-80 mV	+80 mV	3.2 μV	7.5 μV + 0.052% of reading	13 ppm of input per °C
-2 V	+2 V	82 μV	420 μV + 0.044% of reading	13 ppm of input per °C
-3 V	+10 V	500 μV	1.5 mV + 0.063% of reading	45 ppm of input per °C

Current (dc mA)

Range: 0 to 20 mA
 Shunt: 1 Ω to 1 kΩ mounted externally
 Additional deviation due to shunt: 0.1% of input (for 2.49 Ω shunt)

Resistance (ohms)

Range: 0 to 400 Ω (resolution 20 mΩ)
 Calibration accuracy (at 25°C): 120 mΩ + 0.023% of reading
 Temperature performance: 25 ppm of input per °C

RTD (2-wire and 3-wire)

Temperature scale: ITS 90
 Maximum source current: 200 μA
 Range: 0 to 400 Ω (-200 to +850°C)—see Table 2
 Resolution: 0.05 °C
 Calibration accuracy: ± 0.31°C ± 0.023% of measurement in °C at 25°C ambient
 Temperature coefficient: ± 0.01°C/°C ± 25ppm/°C measurement in °C from 25°C ambient
 Electrical noise: 0.05°C peak–peak with τ = 1.6 s input filter
 Linearisation accuracy: 0.0033% (best fit straight line)
 Lead resistance: 0 to 22 Ω matched lead resistances
 Bulb current: 200 μA nominal

Table 2: RTD type details

RTD Type	Overall range (°C)	Standard	Max. linearisation
Cu10	-20 to +400	General Electric Co.	0.02°C
Cu53	-70 to +200	RC21-4-1966	0.01°C
JPT100	-220 to +630	JIS C1604:1989	0.01°C
Ni100	-60 to +250	DIN43760:1987	0.01°C
Ni120	-50 to +170	DIN43760:1987	0.01°C
Pt100	-200 to +850	IEC751	0.01°C
Pt100A	-200 to +600	Eurotherm Recorders SA	0.09°C

Thermocouple

Temperature scale: ITS 90
 Types, ranges and accuracies: See Table 3
 CJC: Types: Off, internal, external, remote
 Remote source: Any input channel
 Internal accuracy: < 1°C max. with instrument at 25°C
 Internal rejection ratio: 40:1 from 25°C
 Upscale/downscale drive: High, low or none, independently configurable for each channel's sensor break detection

Table 3: An In 1–4 Thermocouple types, ranges and accuracies

Thermocouple type	Range (°C)	Standard	Linearisation accuracy
B	0 to +1820	IEC584.1	0 to 400°C = 1.7°C 400 to 1820°C = 0.03°C
C	0 to +2300	Hoskins	0.12°C
D	0 to +2495	Hoskins	0.08°C
E	-270 to +1000	IEC584.1	0.03°C
G2	0 to + 2315	Hoskins	0.07°C
J	-210 to +1200	IEC584.1	0.02°C
K	-270 to +1372	IEC584.1	0.04°C
L	-200 to +900	DIN43710:1985 (to IPTS68)	0.02°C
N	-270 to +1300	IEC584.1	0.04°C
R	-50 to +1768	IEC584.1	0.04°C
S	-50 to +1768	IEC584.1	0.04°C
T	-270 to +400	IEC584.1	0.02°C
U	-200 to +600	DIN43710:1985	0.08°C
NiMo / NiCo	-50 to +1410	ASTM E1751-95	0.06°C
Platinel	0 to +1370	Engelhard	0.02°C
Mi / NiMo	0 to +1406	Ipsen	0.14°C
Pt20%Rh / Pt40%Rh	0 to +1888	ASTM E1751-95	0.07°C

Digital Inputs (Dig In A and Dig In B)

Type: Contact closure
 Short circuit sensing current (source): 5.5 mA (min.) to 6.5 mA (max.)
 Open circuit (inactive) resistance: > 600 Ω
 Closed circuit (active) resistance: < 300 Ω

Relay Outputs (O/P4 and O/P5)

Type: Form A (normally open)
 Contact switching power (resistive): 1 A max. at 240 V RMS ±15%,
5 mA min. at 5 V
 Current through terminals: 1 A
 Isolation: 300 V RMS or dc, double insulated from processor/comms. electronics

Optional I/O

Channel positions Opt1, Opt2 and opt3 can either be fitted with an LLR board (logic, logic, relay) or a DDD board (dc output, dc output, dc output).

LLR Board

Logic input (Opt1 only)

Type:	Active (current on) contact closure sourcing	
Input current:	Input at 12 V:	0 mA min. to 44 mA max
	Input at 0 V:	6 mA (steady state) to 44 mA (switch current)
Open circuit input voltage:	+11 V to +13 V	
Open circuit (inactive) resistance:	> 500 Ω	
Closed circuit (active) resistance:	> 150 Ω	

Logic outputs (Opt1 and/or Opt2)

Type:	Active (current on) current sourcing, or Inactive (current off) current sourcing	
Voltage output across terminals:	Active:	+11 V to +13 V
	Inactive:	0 V to +300 mV
Short circuit output current (active type):	6 mA (steady state) to 44 mA (switch current)	
Output source leakage current into short circuit (inactive type):	0 μA to 100 μA	

Relay (Opt3 only)

Type:	Form A (normally open)
Contact switching power (resistive):	2 A max. at 240 V RMS ±15%
	100 mA min. at 12 V
Current through terminals:	2 A
Isolation:	300 V RMS or dc; double insulated from processor/comms. electronics

DDD Board

mA current outputs (Opt1, Opt2 and Opt3)

Output range:	Configurable within 0 to 20 mA
Load resistance:	500 Ω max.
Calibration accuracy:	$< \pm 100 \mu\text{A} \pm 1\%$ of reading
Resolution:	> 11 bits
Thermal drift:	< 100 ppm/ $^{\circ}\text{C}$
Isolation:	300 V RMS or dc; double insulated from processor/comms electronics

Voltage output (Opt3 only)

Output range:	Configurable within 0 to 10 V dc
Load resistance:	500 Ω min.
Calibration accuracy:	$< \pm 50$ mV $\pm 1\%$ of reading
Resolution:	> 11 bits
Thermal drift:	< 100 ppm/ $^{\circ}\text{C}$
Isolation:	300 V RMS or dc; double insulated from processor/comms electronics

Display and Active Touchscreen Dimensions

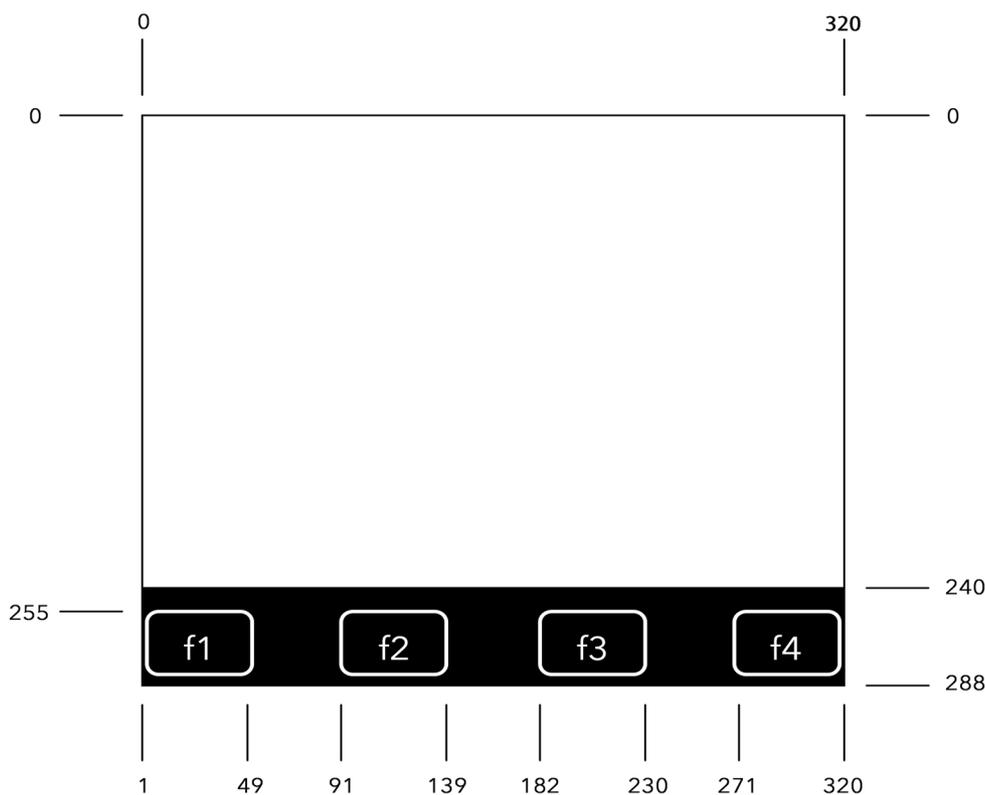
What's in this section

This section shows the dimensions in pixels for the active touch screen area. It includes the display area and the button positions.

The size of the image and, therefore, the size that the visualisation is to be set is 320 × 288 pixels.

The button size and their positions from the top left hand corner are shown in the table below:

Button Size: 48 × 32 pixels	x	y
f1	1	255
f2	91	255
f3	182	255
f4	271	255



A touch in the same location for more than 10 seconds will be filtered out.

It is recommended that the active elements are greater in size than the actual function keys.

The faceplate image is available from the E+PLC installed location, typically:
C:\Program Files (x86)\Eurotherm\E+PLC\E+PLC100\Images.

Hints and Tips

What's in this section

This section provides a place to document miscellaneous useful information.

Recovery from excessive CPU loading

It is possible for an application to be developed that consumes all available CPU bandwidth which would prevent other lower priority tasks from running, this could include the network task resulting in the loss of network connection or not being able to make a network connection. To recover from this situation with a project that has been loaded and is running which contains such a task, but a boot application has not been created, simply power-cycle the device as the application is not retained. However, to recover from this situation with a project that has been loaded and is running which contains such a task AND a boot application has been created, copy the files located in the E+PLC 100. Recovery directory (typically **C:\Program Files (x86)\Eurotherm\E+PLC\E+PLC100\Recovery**) onto the root of a USB memory stick, insert the memory stick into the E+PLC100 device and power-cycle – this will result in the removal of the offending application.

For further information see;

- "Accessing the CODESYS Online Help" on page 39
- CODESYS Online Help > Home > General Topics > Recovery Procedures > Device reset (excessive CPU load)

Recovery from invalid/forgotten network settings

The network settings used by the E+PLC 100 are contained in a **network.ini** file stored in the **/startup** drive on the device. In the event of these network settings being invalid for the network, or being forgotten, a connection can be made using the network settings contained in a **network.ini** file located on the root of a connected USB memory stick. This would allow an application to be developed to modify the internally stored network.ini file with the correct network settings. It should be noted that when the USB memory stick is removed and the device power-cycled, the device will use the network settings from the internally stored **network.ini** file.

For further information see;

- "Accessing the CODESYS Online Help" on page 32
- CODESYS Online Help > Home > General Topics > Recovery Procedures > Reset Device Network settings.

Recovery in the event of a fully built up firewall

It is possible for a firewall rule file to be created that blocks all incoming network traffic which would prevent the device ever being connected. If a device contains such a firewall configuration file, it is possible to open default network ports used by CODESYS by connecting a USB memory stick that contains a file called **fw4.default** in its root directory and power-cycling the device. It should be noted that when the USB memory stick is removed and the device power-cycled, the device will use the internally stored firewall rule file **fw4.cfg** (stored in the **/startup** drive).

The default firewall permits the following:

- All TCP and UDP outbound traffic and their associated inbound responses (allowing Modbus master and FTP archiving communications)
- TCP and UDP inbound traffic from any port to port 53 (allowing DNS communications)
- ICMP traffic with rate limiting conditions (allowing PINGs and other Internet Control messages)
- UDP incoming traffic from any port to ports 1740 to 1743, and TCP incoming traffic from any port to port 11740 (allowing CODESYS IDE and gateway network scanner communications)
- UDP incoming traffic from any port to ports 1210, 1211, 1217 (allowing CODESYS gateway to PLC communications)

It should be noted that the default firewall does not permit the following, and additional firewall rules are required:

- Modbus slave communications (pass in on emac0 proto tcp from any to any port = 502)
- HTML communications (pass in on emac0 proto tcp from any to any port = 8080)
- SNTP communications (pass in on emac0 proto udp from any to any port = 123)

For further information see;

- "Accessing the CODESYS Online Help" on page 32
- CODESYS Online Help > Home > General Topics > Recovery Procedures > Firewall reset.

Line Voltage Measurement for Power Feed Forward Control

The **GetPSULineVoltage** function from the **ECmpPSU** library can be utilised to get the line voltage for the **E_CTRL.LOOP_RUNTIME.rVLine** input.

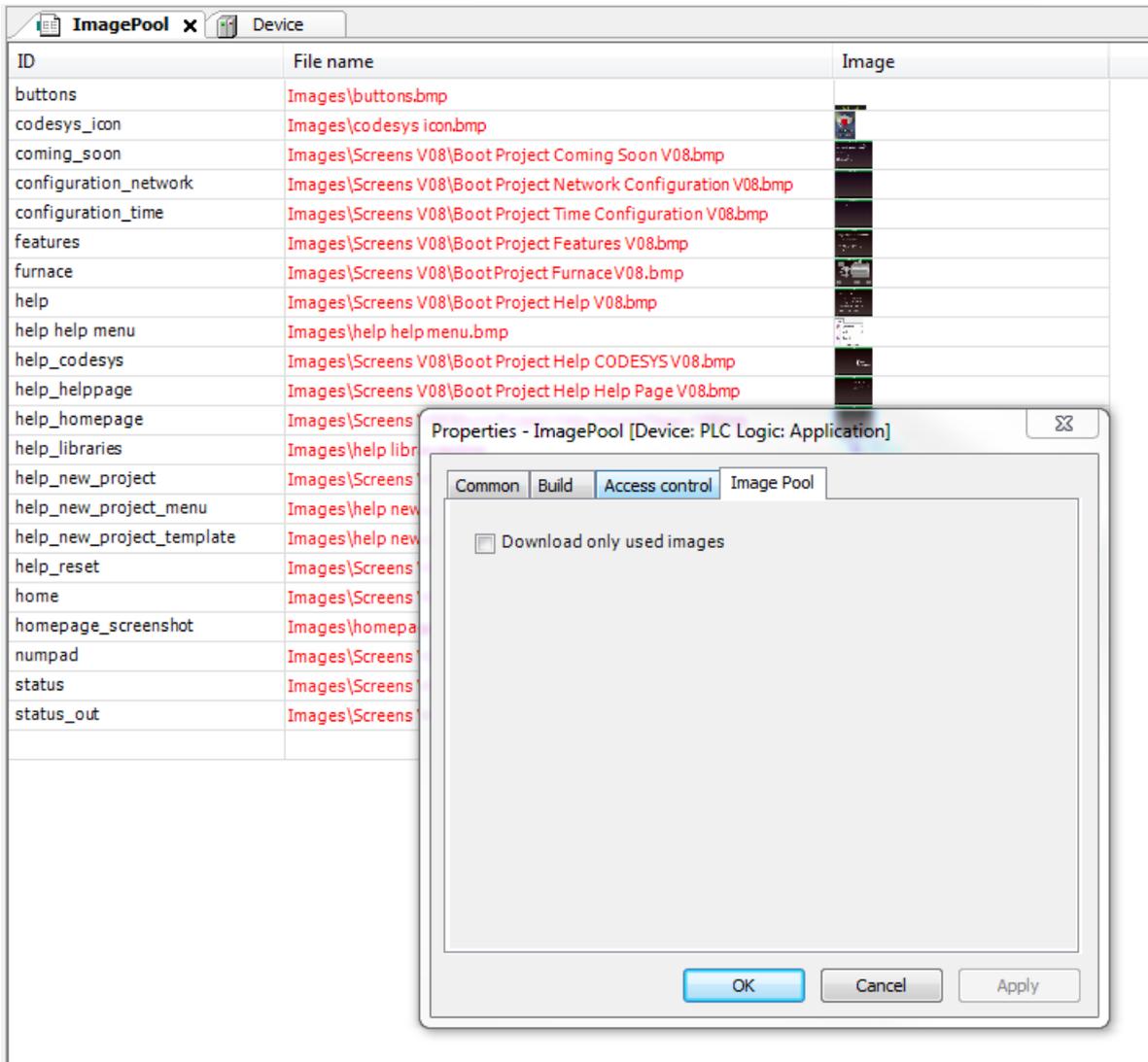
Watchdog functionality

Hardware watchdog – The EE+PLC 100 Controller incorporates a hardware watchdog function that will trigger a device reset if an IO system health check fails.

For further information, refer to the CODESYS Help.

Ensure all images are downloaded

To ensure all images in an image pool are downloaded, verify that the 'Download only used images' attribute is unset as shown below:



NOTICE

E+PLC100 supports 24-bit bitmap images, however, they will be converted down to 16-bit bitmap images to be displayed on the target instrument and therefore image degradation may occur.
E+PLC100 does not support JPEG images on the target instrument in this release.



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As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this publication.

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