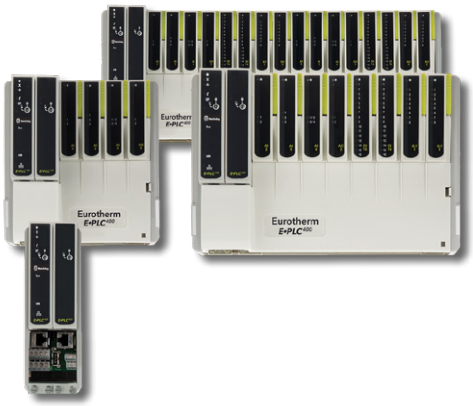
Optimizing efficiency and regulatory compliance

Eurotherm®

E+PLC^{400} Combination PLC

Advanced control, data management and visualization in a modular platform solution



Product at a glance

E+PLC^{400} is a modular PLC designed to meet the stringent regulatory requirements of thermal and other advanced manufacturing industries.

By utilizing the open industry standard IEC 61131-3 CODESYS® platform, E+PLC enables simplified engineering through a single integrated programming and visualization environment.

Includes advanced function block libraries for:

- Heat treatment applications
- Control and data recording
- 'OEM security' and customization

Unique PID control functions designed by Eurotherm™ are built in, enabling faster commissioning and tighter control of the overall process, as well as easing conformance to regulatory and end-customer requirements, including:

- 6 PID sets to help maintain tight control at specific setpoints
- Intelligent auto-tune for optimal control and commissioning
- Specialized cutback function for overshoot control

Data management embedded in E+PLC helps manufacturers meet strict regulatory process data requirements, including:

- Eurotherm tamper-resistant UHH file format (a superior alternative to editable csv files commonly found in PLCs)

Ethernet communication offers connectivity to IIoT (Industrial Internet of Things) and Industry 4.0 technologies.

To assist with operational efficiency, E+PLC^{400} has an embedded webserver for remote viewing on mobile devices, and with local visualization.

Typical application fields

- Industrial furnaces and ovens
- Climate chambers
- Autoclaves
- Sterilizers
- Dryers
- Semiconductor manufacturing
- Specialized machines and test equipment

Easy to use function block libraries

- Auto-tuning PID control
- Data recording
- Batch data management
- Setpoint programming
- Carbon control (including 3GASIR and online diffusion)
- Vacuum control (including active gauge support, auto, and leak rate checks)

IEC 61131-3 Programming Languages

- Ladder Diagram (LD)
- Continuous Function Chart (CFC)
- Function Block Diagram (FBD)
- Instruction List (IL)
- Sequential Function Chart (SFC)
- Structured Text (ST)

CODESYS

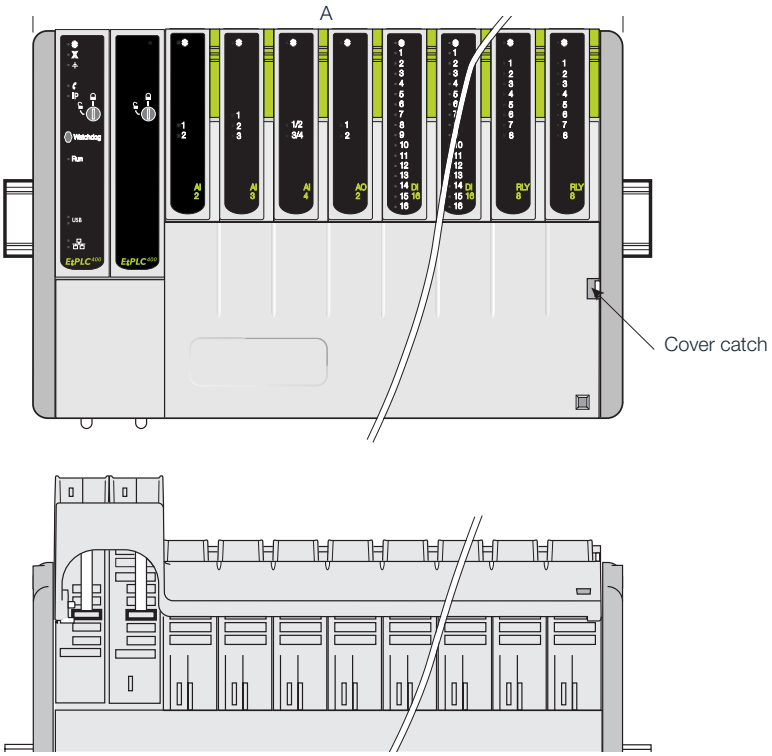
WATLOW®
Powered by Possibility

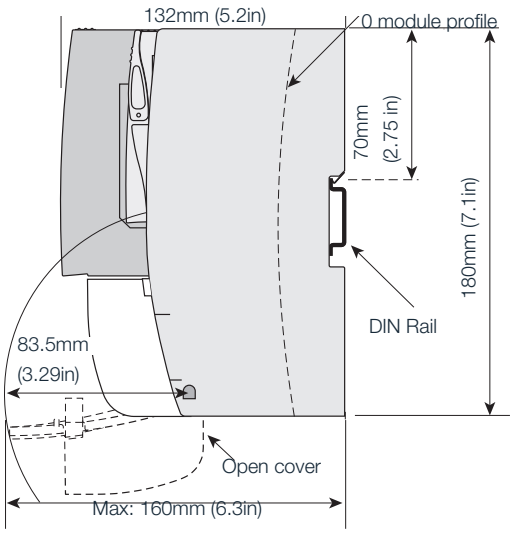
E+PLC^{400} Specification

Base unit details

Base unit								
Modular format	E+PLC^{400} processor module with up to 16 I/O modules							
Module connection	Modules plug onto removable terminal units which provide the wiring interface to the machine or plant							
Base sizes	Bases are available in four lengths, to fit 0, 4, 8, or 16 I/O modules							
Backplane communication	The processor module communicates with the I/O modules via a passive internal module I/O bus running along the width of the base. Each module position is monitored separately to provide continuous I/O bus communication during live replacement of I/O modules.							
Base composition	The base consists of an aluminum extrusion, the internal I/O bus and mounting supports.							
Mounting	Designed for horizontal DIN rail mounting (as shown in Dimensions diagram below), or direct attachment to a bulkhead or mounting plate.							
DIN rail type	Symmetrical DIN rail to EN50022 (35mm x 7.5mm or 35mm x 15mm) (1.3inches x 0.3inches or 1.4inches x 0.6inches)							
Case protection rating	IP20							
Ventilation space required	25mm (1 inch) free space above and below							
Weight for different base lengths (approx. dependent on I/O module types)	**0 module base**		**4 module base**		**8 module base**		**16 module base**	
	kg	**lb.**	**kg**	**lb.**	**kg**	**lb.**	**kg**	**lb.**
Base weight (no processor or I/O modules fitted)	0.35	0.77	0.7	1.54	1.0	2.16	1.6	3.53
Base weight (all processor and I/O modules fitted)	0.7	1.54	1.65	3.64	3.1	6.83	5.3	11.68

Dimensions





Base Size	A mm (inches)
0 module	61.25 (2.41)
4 module	162.75 (6.41)
8 module	274 (10.8)
16 module	477 (18.8)

E+PLC400 Specification

Processor module and communications

Controller	
Supply voltage range	24V dc ± 20%
Power consumption	<82W maximum for fully loaded rack
Fuse rating	0.5A time delay (Not customer replaceable)
Surge current	8A maximum
CPU	Freescale™ Semiconductor PowerQUICC™ II Pro processor MPC8313
Bus size	32 bit
System clock	333MHz
USB	One USB 2.0 port connected on terminal unit, maximum current 500mA
USB peripherals supported	Memory stick (8GB max.)
Memory resources	Dynamic RAM for Application/Visualization 90MB approx. Flash Memory 106MB approx. for data recording (data log files transferred by FTP or USB) Retain/Persistent Memory 2MB approx.
Watchdog reset	Push switch on front panel of microprocessor module
Watchdog relay	
Type	SPST, connected on the terminal unit
Contact rating (resistive)	24V ac/dc at 0.5A
Isolation	30V ac rms or 60V dc
SD memory card	
Type	SDHC
Size	80MB (Firmware 16MB approx, free space 64MB approx).
Stored data	Firmware, application files, setpoint programs, recipes, user data files, XML files etc.
Integrated development environment	
Software	CODESYS IDE Version 3 with E+PLC packages

Ethernet	
Protocol	Modbus TCP configurable as master and slave, or user application access (for example: custom TCP/IP protocols, printer connections) OPC-DA via PC based software
Physical connection	10/100Base-T, RJ45 connector on controller module
Cable type	Ethernet Cat 5 shielded
Speed	10/100Base-T auto-select
Line length	100 meters (328 ft) max. extendable by repeater
Allocation of IP address	Fixed, DHCP
Modbus TCP slaves	32 max. (16 max. previous to CODESYS runtime V3.5.9.60, E+PLC V1.2.0.0)
Isolation	50V dc; 30V ac (IEEE802.3)
Serial communications	
Protocol	Modbus RTU configurable as master or slave, RS-485 (3 wire/5 wire), jumper select
Physical connection	Two in-line RJ45 connectors on terminal unit, 3 wire/5 wire (jumper select)
Cable type	Cat 5 shielded twisted pair
Line impedance	120Ω-240Ω twisted pair
Line length	1220m (4000ft) max. at 9600 bits/sec
Protocol	Modbus RTU configurable as master or slave
Modbus RTU slaves	32 max. (16 max. previous to CODESYS runtime V3.5.9.60, E+PLC V1.2.0.0)
Note: Use of a communications buffer/isolator is recommended	

E+PLC400 Specification

Data recording, PID and standard library functions

Data recording update/archiving		
Sample rate	10Hz	
Trend update	10Hz guidance limit[1]	
Recording groups	32	
Recording channels	**Guidance limit[1]**	**Absolute limit**
Recording points per group	32	127
Display channels per group	8	127

PID loops (16 way rack)	Guidance limit[1]	Absolute limit
Number of loops (4-20mA outputs)	16	24
Number of loops (time proportional)	32	80
Note: For ultimate precision this assumes all I/O are in one rack		

Standard library functions
Inputs
• Universal inputs (mA, RTD, TC, V) • Signal conditioning (filter, temperature conversion, etc.) • Calibration (offset, scaling)
Control
• Logic functions • PID control (autotune, cutback etc.) • Setpoint programming/setpoint profiler • Visualization (PID faceplate)
Data recording and archiving
• Batch management • Archiving FTP • Trend visualization
Carbon control
• Zirconia (carbon potential, dewpoint, oxygen) • Carbon profile visualization • 3GasIR • Probe cleaning • Soot prediction • Impedance measurement
Vacuum control
• Vacuum gauge linearization • Vacuum leak test (rate, leak-up) • Vacuum gauge switch • Vacuum pump-down timer
Other
Thermocouple life (based on AMS2750E)
Time synchronization (SNTP)
Modbus library (Eurotherm 3200i, EPack, EPower, Mini8)

[1] 'Guidance limit' represents a practical number considering average memory usage and execution speed of a typical control application, including typical visualizations and navigation for the operator.

E+PLC^{400} Specification

Diagnostics, environmental specifications, approvals and compliance

Diagnostics

Processor, communications and I/O diagnostics information is available via LEDs on the front of the modules. More advanced diagnostics are available remotely using the CODESYS function blocks. On power-up, the E+PLC^{400} automatically performs power-on self-tests which diagnose and assess instrument health. The LEDs indicate the module's status in the case of a controller detected fault.

Processor module

Processor module diagnostic LEDs		
LED identification symbol	**Color**	**Indicated status**
*	Green	Module powered and operating correctly
X	Red	Controller detected a missing module or abnormal operating state during internal self-diagnostic routine
⏚	Green	Backup battery healthy (if fitted)
📞	Yellow	Serial communications activity
IP	Yellow	Unit has resolved an IP address for Ethernet communications
Run	Green	Program is loaded and running
USB (link)	Green	USB device inserted and powered
USB (current limit)	Yellow	Current limit exceeded
Ethernet (link speed)	Green	100Mbit/s operation
Ethernet (link activity)	Yellow	Connected to live network Ethernet traffic detected (flashing)

I /O modules

I/O module diagnostic LEDs		
LED identification	**Color**	**Indicated status**
*	Green	Powered and operating correctly
Analog channel number	Red	Controller detected fault
Digital channel number	Yellow	Channel state (on/off)

Environmental specifications, approvals and compliance		
Operating temperature		0 to 55 °C / 0 to 131 °F
Storage temperature		-25 to 55 °C / -13 to 185 °F
Relative humidity		5 to 95% (non-condensing)
Shock/Vibration		BS EN61131-2, section 4.2.1 (5 to 150 Hz. at 1G; 0.5 octaves per min.)
Altitude		<2000 meters / <6560 ft
Electromagnetic compatibility (EMC)	Emissions	BS EN 61326 Class A – Heavy industrial
	Immunity	BS EN 61326 Industrial
Regional approvals	Europe	CE, RoHS, REACH
	USA, Canada	UL, cUL
	Russia	EAC and Metrological Pattern Approval
	China	CCC exempt (product not listed in catalog of products subject to China Compulsory Certification), RoHS
Industry specific standards	Nadcap	E+PLC^{400} is suitable for use in Nadcap applications in all furnace classes A-E, as defined in section 3 of the AMS2750E standard For more information, see www.eurotherm.com/certificates
Electrical safety		BS EN61010-1 (Installation category II, Pollution degree 2). Protective earth ground and cable shield connections are made to ground terminals at the bottom of the base unit.

E+PLC^{400} Specification

Input, output and linearization types

Module types

Code	Description	Update rate
AI2-DC	Two channel isolated dc analog input module	110ms
AI2-TC	Two channel isolated thermocouple analog input module with CJC	110ms
AI2-MA	Two channel isolated mA analog input module	110ms
ZI	Two channel isolated zirconia analog input module	110ms
AI3	Three channel isolated 4-20mA analog input module with 24V transmitter PSU	110ms
AI4-MV	Four channel mV analog input module, channels isolated in pairs	110ms
AI4-TC	Four channel thermocouple analog input module with CJC, channels isolated in pairs	110ms
AI4-MA	Four channel mA analog input module, channels isolated in pairs	110ms
AI8-TC	Eight channel thermocouple analog input module with CJC, channels isolated in pairs	110ms
AI8-RT	Four channel isolated resistance/RTD analog input module	110ms
AI8-MA	Eight channel mA analog input module (110ms update rate), channels isolated in pairs	110ms
AI8-FMA	Eight channel mA analog input module (20ms update rate), channels isolated in pairs	20ms
AO2	Two channel isolated dc analog output module	110ms
DI6-115V	Six channel isolated 115V ac digital input module	110ms
DI6-230V	Six channel isolated 230V ac digital input module	110ms
DI16	Sixteen channel digital input module	10/110ms
DO16	Sixteen channel digital output module	10/110ms
RLY8	Eight channel isolated relay output module	10/110ms

Linearization tables and math equations

RTD and thermocouple linearizations are included in E+PLC^{400}, see below tables for types. Custom linearization tables are available, with up to 255 break points. Mathematical equations are also available for functions such as SqRoot, powers (e.g. $x^{3/2}$, $x^{5/2}$) and polynomials etc.

RTD Types					
RTD Type	Overall range		Standard	Linearization accuracy	
	(°C)	(°F)		(°C)	(°F)
Cu10	-20 to 400	-4 to 752	General Electric Co.	0.02	0.04
Cu53	-70 to 200	-94 to 392	RC21-4-1966	0.01	0.02
JPT100	-220 to 630	-364 to 1166	JIS C1604:1989	0.01	0.02
Ni100	-60 to 250	-76 to 482	DIN43760:1987	0.01	0.02
Ni120	-50 to 170	-58 to 338	DIN43760:1987	0.01	0.02
Pt100	-200 to 850	-328 to 1562	IEC751	0.01	0.02
Pt100A	-200 to 600	-328 to 1112	Eurotherm Recorders SA	0.09	0.16
Pt1000	-200 to 850	-328 to 1562	IEC751	0.01	0.02

Thermocouple types					
T/C type	Overall range		Standard	Linearization accuracy	
	(°C)	(°F)		(°C)	(°F)
B	0 to 1820	32 to 3308	IEC584.1	0 to 400: 1.7 400 to 1820: 0.03	0 to 752: 3.1 752 to 3308: 0.05
C	0 to 2300	32 to 4172	Hoskins	0.12	0.22
D	0 to 2495	32 to 4523	Hoskins	0.08	0.14
E	–270 to 1000	-454 to 1832	IEC584.1	0.03	0.05
G2	0 to 2315	32 to 4199	Hoskins	0.07	0.13
J	–210 to 1200	-346 to 2192	IEC584.1	0.02	0.04
K	–270 to 1372	-454 to 2501	IEC584.1	0.04	0.07
L	–200 to 900	-328 to 1652	DIN43710:1985 (to IPTS68)	0.02	0.04
N	–270 to 1300	-454 to 2372	IEC584.1	0.04	0.07
R	–50 to 1768	-58 to 3214	IEC584.1	0.04	0.07
S	–50 to 1768	-58 to 3214	IEC584.1	0.04	0.07
T	–270 to 400	-454 to 752	IEC584.1	0.02	0.04
U	–200 to 600	-328 to 1112	DIN43710:1985	0.08	0.14
Ni/NiMo	–50 to 1410	-58 to 2570	ASTM E1751-95	0.06	0.11
Platinel	0 to 1370	32 to 2498	Engelhard	0.02	0.04
Mi/NiMo	0 to 1406	32 to 2563	Ipsen	0.14	0.25
Pt20%Rh/ Pt40%/Rh	0 to 1888	32 to 3430	ASTM E1751-95	0.07	0.13
MoRe	0 to 2000	32 to 3632	Eurotherm	1.2	2.2

E+PLC400 Specification

AI2 modules

AI2 Two channel analog input module

The AI2 analog input module is available with three different terminal unit options for either DC, TC or mA input.

AI2-DC Two channel isolated dc input module

This option comprises an AI2 module and DC terminal unit, for mV, V, resistance, RTD, and pot. position sensing applications. Channel 2 has an additional high impedance input range for use with zirconia probe oxygen sensors. However, if probe impedance checking is also required, a zirconia input (ZI) module is a more suitable option.

General	
Number of channels	2
Power consumption	2W max.
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation)
Mains rejection	>120dB (47 to 63Hz) common mode >60dB (47 to 63Hz) series mode
Millivolt input (mV)	
Range	–150mV to +150mV
Initial accuracy	±0.1% of reading, ±10µV max
Resolution	Better than 0.001% of range
Voltage input (V)	
Range	–10.3V to +10.3V
Initial accuracy	Better than ±0.1% of reading, ±2mV
Resolution	Better than 0.001% of range
Resistance input (Ω)	
Range	0Ω to 560Ω, supporting 2, 3 or 4 wire sensor connection
Initial accuracy	Better than 0.1% of reading, ±0.1Ω
Resolution	Better than 0.04Ω with t=1.6 second filter
High resistance input for RTDs (Ω)	
Range	0Ω to 6kΩ, supporting 2, 3 or 4 wire sensor connection
Initial accuracy	Better than 0.1% of reading, ±0.6Ω
Resolution	Better than 0.25Ω with t=1.6 second filter
RTD types	Refer to RTD Type table page 6
Potentiometer input	
Range	0% to 100% rotation positioning of 100Ω to 6kΩ linear pot
Resolution	Better than 0.01% of range, with t= 1.6 second filter and 6kΩ pot.
High impedance input (channel 2 only) for zirconia probes	
Range	0.0V to +1.8V
Initial accuracy	Better than 0.1% of reading ±20µV
Resolution	Better than 0.001% of range

Note: User calibration options can improve performance, limited by measurement noise and non-linearity

E+PLC400 Specification

AI2 modules

AI2-TC Two channel isolated thermocouple input module

This option comprises AI2 module and TC terminal unit fitted with CJC sensor, for thermocouple inputs. It can also be used to measure inputs from other low range mV sensors such as pyrometers. Channel 2 has an additional high impedance input range for use with zirconia probe oxygen sensors. However, if probe impedance checking is also required, a zirconia input (ZI) module would be a more suitable option.

Thermocouple and millivolt input (mV)	
Number of channels	2
Power consumption	2W max.
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation)
Mains rejection	>120dB (47 to 63Hz) common mode >60dB (47 to 63Hz) series mode
Input range	–150mV to +150mV
Initial accuracy	±0.1% of reading, ±10µV max
Resolution	Better than 0.001% of range
CJC system	Pt100 RTD, located beneath terminal unit input connector
Initial CJC accuracy	±0.5°C typical (±1.0°C max.)
CJC rejection	>30:1 over operating temperature range
Thermocouple linerization types	Refer to Thermocouple Type table page 6

AI2-MA Two channel isolated mA input module

This option provides an AI2 module and MA terminal unit fitted with high precision 5Ω shunt, for current loop applications.

Current input	
Number of channels	2
Power consumption	2W max.
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation)
Mains rejection	>120dB (47 to 63Hz) common mode >60dB (47 to 63Hz) series mode
Input range	–30mA to +30mA with 5Ω shunt resistor in the terminal unit
Initial accuracy	Better than 0.25% of reading ±2uA
Resolution	Better than 0.001% of range
Shunt resistor	5Ω resistor fitted to terminal unit

Note: User calibration options can improve performance, limited by measurement noise and non-linearity

E+PLC400 Specification

ZI modules

ZI Two channel isolated Zirconia input module

The ZI module comprises two analog input channels, optimized for zirconia probe oxygen sensor measurements. Channel 1 with CJC sensor fitted provides a mV measurement for a thermocouple input, while Channel 2 provides a high impedance input range suitable for a zirconia probe signal. The zirconia function block includes an impedance test to indicate the health of the probe.

General	
Number of channels	2
Power consumption	1.8W max.
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation)
Mains rejection	>80db, (48 to 62Hz) common mode >60db, (48 to 62Hz) series mode
Millivolt input (mV) for thermocouple (Channel 1 only)	
Input range	–150mV to +150mV
Initial accuracy	±0.1% of electrical input, ±10µV max.
Measurement noise	5µV p-p with t=1.6s filter
Resolution	Better than 2µV with t=1.6s filter
Sensor break detect	250nA break high, low or off
Input impedance	10MΩ
CJC system	Pt100 RTD, located beneath terminal unit input connector
Initial CJC accuracy	±0.5°C typical (±1.3°C max.)
CJC rejection	>30:1 over operating temperature range
CJC sensor temperature range	–10°C to +70°C
Thermocouple linearization types	Refer to Thermocouple Type table page 6
High impedance millivolt input (mV) for zirconia probe (Ch2 ONLY)	
Input range	0mV to +1800mV
Initial accuracy	±0.2% of electrical input
Measurement noise	0.1mV p-p with t=1.6s filter
Resolution	50µV with t=1.6s filter
Sensor impedance measurement	0.1kΩ to 100kΩ ±2%
Input impedance	500MΩ
Input leakage current	±4.0nA max, ±1nA typical

Note: User calibration options can improve performance, limited by measurement noise and non-linearity

E+PLC400 Specification

AI3 and AI4 modules

AI3 Three channel isolated 4-20mA analog input module with 24V transmitter power supply

The AI3 module and terminal unit is ideal for current loop transmitter applications. Each isolated channel includes a loop power supply for the transmitter if needed.

The power supply includes a current overload protection feature which automatically resets when the overload is cleared.

Milliamp input (mA)	
Number of channels	3
Power consumption	<1.2W for current input mode with no load. Up to 0.5W dissipated per load, (2.7W with 3 powered loops)
System isolation	300V RMS or dc (double insulation)
Channel isolation	50V RMS or dc (basic insulation)
Mains rejection	>120dB (47 to 63Hz) common mode >60dB (47 to 63Hz) series mode
Input range	–28mA to +28mA
Initial accuracy	Better than 0.1% of reading ±2uA
Resolution	Better than 0.002% of range with t=1.6 second filter (1.1µA)
Loop shunt resistor	60Ω nominal, 50mA maximum current Shunt resistance can be increased to 250Ω for HART communication by cutting a track link on the terminal unit.
Channel PSU	22V min. (at 21mA) to 30Vmax. (at 4 mA). Current limit 33mA nominal. Self-resetting after overload.

AI4 Four channel analog input module

The AI4 analog input module is available with three different terminal unit options for either mV, TC or mA applications.

AI4-MV Four channel mV input module (isolated in pairs)

This option provides an AI4 module with a MV terminal unit for mV inputs from a variety of sensors, including pyrometers. Channels are isolated in pairs (Channels 1 and 2 isolated from Channels 3 and 4).

Millivolt input (mV)	
Number of channels	4
Power consumption	2W maximum
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation). Isolated in pairs (Channels 1 and 2 isolated from Channels 3 and 4).
Mains rejection	>120dB (47 to 63Hz) common mode >60dB (47 to 63Hz) series mode
Input range	–150 to +150mV at input impedance >20MΩ
Initial accuracy	Better than 0.1% of reading ±10µV
Resolution	Better than 0.002% of range with t=1.6 second filter (6µV)
Note: Wiring and sensor choice should be carefully considered to minimize ground loops when using non-isolated sensors	

Note: User calibration options can improve performance, limited by measurement noise and non-linearity

E+PLC400 Specification

AI4 modules

AI4-TC Four channel thermocouple input module (isolated in pairs)

This option comprises an AI4 module and a TC terminal unit fitted with CJC sensor, for thermocouple inputs. It can also be used to measure inputs from other low range mV sensors, such as pyrometers. Channels are isolated in pairs (Channels 1 and 2 isolated from Channels 3 and 4).

Thermocouple and millivolt input (mV)	
Number of channels	4
Power consumption	2W maximum
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation). Isolated in pairs (Channels 1 and 2 isolated from Channels 3 and 4).
Mains rejection	>120dB (47 to 63Hz) common mode >60dB (47 to 63Hz) series mode
Input range	–150mV to +150mV
Initial accuracy	Better than 0.1% of reading ±10uV
Resolution	Better than 2uV
CJC system	Pt100 RTD, located beneath input connector
Initial CJC accuracy	±0.5°C typical (±1°C maximum)
CJC rejection	30:1 over operating temperature range
Thermocouple linearization types	Refer to Thermocouple Type table page 6
Note: Wiring and sensor choice should be carefully considered to minimize ground loops when using non-isolated sensors	

AI4-MA Four channel mA input module (isolated in pairs)

This option provides an AI4 module and a MA terminal unit fitted with 5Ω shunt resistor, for current loop applications. Channels are isolated in pairs (Channels 1 and 2 isolated from Channels 3 and 4).

Milliamp input (mA)	
Number of channels	4
Power consumption	2W maximum
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation). Isolated in pairs (Channels 1 and 2 isolated from Channels 3 and 4).
Mains rejection	>120dB (47 to 63Hz) common mode >60dB (47 to 63Hz) series mode
Input range	–30mA to +30mA with 5Ω shunt resistor in the terminal unit
Initial accuracy	0.25% of reading ±2µA
Resolution	Better than 0.002% of range with t=1.6 second filter (1.2µA)
Note: Wiring and sensor choice should be carefully considered to minimize ground loops when using non-isolated sensors	

Note: User calibration options can improve performance, limited by measurement noise and non-linearity

E+PLC400 Specification

AI8 modules

AI8 Eight channel analog input module (4 channel for RTD option)

The AI8 analog input module is available with four different terminal unit options for thermocouple, resistance/RTD, mA (110ms update rate) or mA (10ms update rate) applications.

AI8-TC Eight channel thermocouple input module (isolated in pairs)

This option comprises an AI8 module and TC terminal unit fitted with CJC sensor, for higher density thermocouple applications. It can also be used to measure inputs from other low range mV sources with output impedance >1kΩ (floating or grounded). Channels are isolated in pairs (Channels 1 & 5, 2 & 6, 3 & 7, 4 & 8).

Thermocouple and milivolt (mV) input	
Number of channels	8
Power consumption	1.8W maximum
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation) galvanically isolated in pairs
Mains rejection	>120dB (47 to 63Hz) common mode >60dB (47 to 63Hz) series mode
mV range	–80mV to +80mV at input impedance >100kΩ
Initial accuracy	±8µV for readings inside ±8mV; ±0.1% of mV reading for values outside ±8mV
Resolution (over full mV range)	>17 bit with t=1.6s filter (±1.5µV); 16 bit with no filter (±3µV)
CJC sensor system	2 x Pt100 RTDs, located beneath terminal unit input connector
Initial CJC accuracy	±0.8°C
CJC rejection	30:1 over operating temperature range
Thermocouple linearization types	Refer to Thermocouple Type table page 6
Note: Wiring and sensor choice should be carefully considered to minimize ground loops when using non-isolated sensors	

AI8-RT Four channel isolated resistance/RTD input module

This option comprises an AI8 module and RT terminal unit for resistance inputs. Supports four inputs from two/ three wire RTD sensors.

General	
Number of channels	4
Power consumption	1.8W maximum
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation)
Mains rejection	>120dB (47 to 63Hz) common mode >60dB (47 to 63Hz) series mode
RTD type linearization tables	Refer to RTD Type table page 6
Low resistance input	
Range	20Ω to 500Ω with 2 or 3 wire lead compensation
Initial accuracy	500Ω range: ±50mΩ for readings <50Ω; ±0.1% of reading for resistance readings >50Ω
Resolution	>17bit (±8mΩ) with t=1.6s filter, 16bit (±16mΩ) with no filter
High resistance input	
High ohms range	200Ω to 5kΩ with 2 or 3-wire lead compensation
Initial accuracy	5kΩ range: ±500mΩ for readings <500Ω; ±0.1% of reading for resistance readings >500Ω
Resolution	>17bit (±8mΩ) with t=1.6s filter, 16bit (±16mΩ) with no filter

E+PLC400 Specification

AI8 modules

AI8-MA Eight channel mA input module (isolated in pairs)

This option comprises an AI8 module and MA terminal unit with 3.3Ω shunt resistor fitted, for higher density mA input applications. Channels are isolated in pairs (Channels 1 & 5, 2 & 6, 3 & 7, 4 & 8). The update rate of the channels is 110ms. For applications requiring a faster update rate, the AI8-FMA module may be a more suitable option.

Milliamp input (mA)	
Number of channels	8
Power consumption	1.8W maximum
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation) galvanically isolated in pairs
Mains rejection	>120dB (47 to 63Hz) common mode >60dB (47 to 63Hz) series mode
mA range	–20mA to +20mA
Initial accuracy	±3.6µA for values inside ±2.4mA. ± 0.15% of reading outside ±2.4mA
Resolution (over full mA range)	17bit with t=1.6s filter (±0.5µA); 16 bit with no filter (±1.0µA)
Update rate	110ms
Shunt resistor	3.33Ω resistor fitted to terminal unit
Note: Wiring and sensor choice should be carefully considered to minimize ground loops when using non-isolated sensors	

AI8-FMA Eight channel mA input module with 20ms update rate (isolated in pairs)

This option comprises an AI8 module and MA terminal unit with 3.3Ω shunt resistor fitted, for higher density mA input applications that require faster update rates than the AI8-MA module. Channels are isolated in pairs (Channels 1 & 5, 2 & 6, 3 & 7, 4 & 8).

Milliamp input (mA)	
Number of channels	8
Power consumption	1.8W maximum
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation) galvanically isolated in pairs
mA range	–20mA to +20mA
Initial accuracy	±3.6µA for values inside ±2.4mA (full ambient temperature range) ± 0.15% of reading outside ±2.4mA (full ambient temperature range)
Resolution (over full mA range)	>17bit with t=1.6s filter (±0.5µA); 16 bit with no filter (±1.0µA)
Update rate	20ms
Shunt resistor	3.33Ω resistor fitted to terminal unit
Note: Wiring and sensor choice should be carefully considered to minimize ground loops when using non-isolated sensors	

E+PLC400 Specification

AO2 modules

AO2 Two channel isolated dc output module

The AO2 module and terminal unit comprises two isolated analog output channels, independently configurable for current (mA) or Voltage (V) output.

General	
Number of channels	2
Power consumption	2.2W
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation)
Voltage (V)	
Voltage output	–0.1 to +10.1V range: 20mA max, 550Ω min load –0.3V to +10.3V range: 8mA max,1500Ω min load
Initial accuracy	Better than ±0.1% of reading, max. offset ±10mV
Resolution	Better than 1 part in 10,000 (0.5mV typical)
Current (mA)	
Current output	–0.1 to 20.5mA; 10V dc max. with total load <500Ω
Initial accuracy	Better than ±0.1% of reading, max. offset ±20µA
Resolution	Better than 1 part in 10,000

E+PLC400 Specification

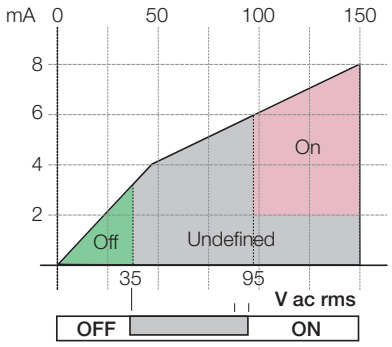
DI6 modules

DI6-115V Six channel isolated 115V digital input module

This option comprises a DI6-115V module and terminal unit, for 115V AC logic inputs. The voltage is factory set and cannot be changed by the user.

115V ac logic input	
Number of channels	6
Power consumption	0.5W max.
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation)
Input functions	On/Off or de-bounce
Frequency	47Hz-63Hz
Active ON state (logic 1 voltage)	95V ac RMS to 150V ac RMS
Inactive OFF state (logic 0 voltage)	<35V ac RMS
Input current required for 'ON' state	>2mA
Maximum input current	8mA at 150V ac RMS
Transient immunity	EN61326

V-I curve for 115V ac Operation

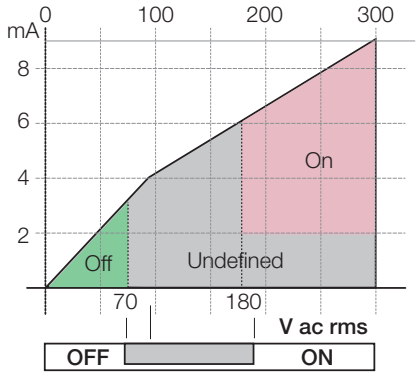


DI6-230V Six channel isolated 230V digital input module

This option provides a DI6-230V module and terminal unit, for 230V AC logic inputs. The voltage is factory set and cannot be changed by the user.

230V ac logic input	
Number of channels	6
Power consumption	0.5W max.
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation)
Input functions	On/Off or de-bounce
Frequency	47Hz-63Hz
Active ON state (logic 1 voltage)	180V ac RMS to 300V ac RMS
Inactive OFF state (logic 0 voltage)	<70V ac RMS
Input current required for 'ON' state	>2mA
Maximum input current	9mA at 300V ac RMS
Transient immunity	EN61326

V-I curve for 230V ac Operation



E+PLC400 Specification

DI16 and DO16 modules

DI16 Sixteen channel digital input module

The DI16 module and terminal unit comprises sixteen digital inputs for voltage input or contact closure applications.

General	
Number of channels	16
System isolation	300V RMS or dc (double insulation)
Channel isolation	Channels share a common connection ('C')
Max. voltage across any channel	30V dc
Contact input mode	
Power consumption	Module: 2.0W maximum
Power supply	16 to18V dc
Contact closure ON state	Input resistance threshold <1KΩ typical
Contact closure OFF state	Input resistance threshold >7KΩ typical
Wetting current	4mA
Wetting voltage	12V dc
Logic input mode	
Power consumption	Module: 0.75W maximum
Logic input ON state	Input voltage threshold >10.8V dc, +30V max.
Logic input OFF state	Input voltage threshold <5.0V dc, –30V min.
Input current	3.8mA at 12V dc; 2.8mA at 24V dc

DO16 Sixteen channel digital output module

The DO16 module and terminal unit comprises sixteen logic outputs, typically used for control, alarm and event applications. Each channel can drive up to 0.7A and can be used for driving devices such as solenoids, relays, lamps, fans, thyristor units and single/three phase solid state relays (SSRs).

General	
Number of channels	16
Power consumption	Module: 0.6W maximum
System isolation	300V RMS or dc (double insulation)
Channel isolation	Channels share a common 'C' connection
Voltage supply (external)	24Vdc ±20%
Maximum current ON State (Logic1)	0.7A per channel
Leakage current OFF state (Logic 0)	<10uA
Module thermal cut-off temperature	90±3°C; restart 88±3°C
Short circuit protection	0.7A to 1.7A per channel
Output voltage	Voltage supply (Vs) minus 1V

E+PLC400 Specification

RLY8 modules

RLY8 Eight channel isolated relay output module

The RLY8 module and terminal unit comprises eight relay outputs. These outputs may require external snubber circuits to be fitted for suppression of transient voltages (depending on application).

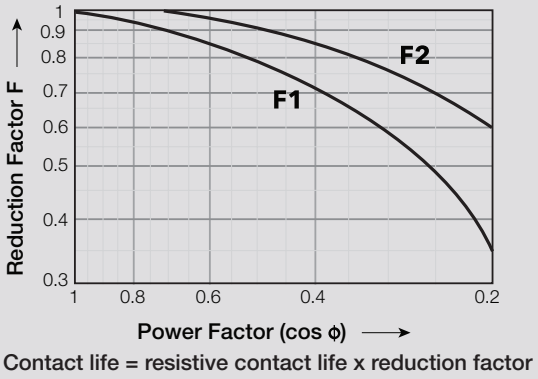
Relay output	
Number of channels	8 normally open, AgCdO contacts
Power consumption	2.5W
System isolation	300V RMS or dc (double insulation)
Channel isolation	300V RMS or dc (basic insulation)
Max. current rating	2A at up to 240V ac; 0.5A at 200V dc, increasing to 2A at 50V dc resistive
Min. current rating	100mA at 12V
Contact life (resistive load)	>10 million operations at 240V ac, 1A RMS (approx.) >600,000 operations at 240V ac, 2A RMS (approx.)
Mechanical life	>30 million operations (approx.)
De-rating	The above estimated ratings summarize typical performance with resistive loads. With complex loads further de-rating may be required.

Relay de-rating

AC Voltage

As the AC load becomes more “difficult” a more significant de-rating factor is required. The graph below shows worst case and typical reduction factor curves for inductive loads. Assuming the power factor of the load is pre-defined, an approximate reduction factor can be selected and applied to contact life.

Reduction factor for ac inductive loads



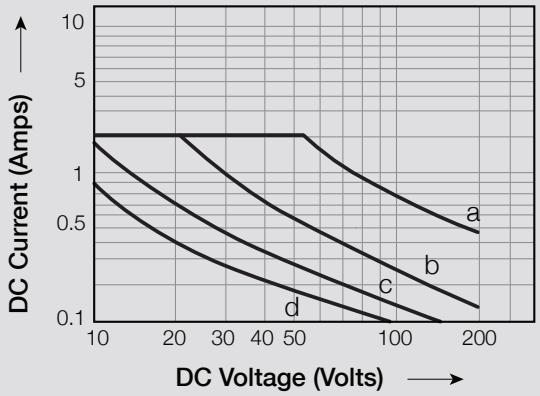
Contact life = resistive contact life x reduction factor

F1 = Worst case
F2 = Typical
Contact life (number of operations) =
Contact life (resistive) x reduction factor

DC Voltage

DC operation is limited for difficult loads, particularly where there is significant inductance. The curves below show the current limitation required against dc voltages, for resistive and inductive loads, where time constants (L/R) examples in ms are the significant factor.

Maximum dc inductive load breaking capacity



a - resistive
b - L/R = 20ms
c - L/R = 40ms
d - L/R = 60ms

E+PLC^{400} Specification

Order code specifications

E+PLC^{400} Order Codes

E+PLC400	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24	25
							XXXXXX	NONE	NONE	NONE	NONE	NONE	NONE
	26	27	28	29	30	31	32	33	34	35	36	37	38
	NONE	NONE	NONE	NONE	NONE	XXXXXX	XXXXXX	NONE	NONE	NONE	XXXXXX	XXXXXX	
	39	40											
	XXXXXX												

Note: Grey order code boxes are pre-filled with E+PLC^{400} model code. Only white boxes need to be filled to complete your order code specification.

Basic product	
E+PLC400	Modular PLC

1	Base Size
00	0 Way base (0 I/O slots)
04	4 Way base (4 I/O slots)
08	8 Way base (8 I/O slots)
16	16 Way base (16 I/O slots)

2	Battery Required
BATT	Battery fitted (default)
NOBATT	Battery not fitted

3-18	Slot 1-16
BLANK	Blank terminal unit
NONE	No I/O module fitted (default)
AI2-DC	2 ch – isolated DC (V, mV, Ω) input module
AI2-TC	2 ch – isolated TC input module with CJC
AI2-MA	2 ch – isolated mA input module with 5Ω shunt
AI3	3 ch – isolated 4-20mA input module with 24V Tx PSU
AI4-TC	4 ch – isolated in pairs, TC input module with CJC
AI4-MA	4 ch – isolated in pairs, mA input module
AI4-MV	4 ch – isolated in pairs, mV input module
AI8-RT	4 ch – isolated RTD input module
AI8-TC	8 ch – isolated in pairs, TC input module
AI8-MA	8 ch – isolated in pairs, mA input module
AI8-FMA	8 ch – isolated in pairs, fast mA input module (20ms)
AO2	2 ch – isolated DC (V or mA) output module
DI6-230V	6 ch – 230V ac digital input module
DI6-115V	6 ch – 115V ac digital input module
DI16	16 ch – digital input module
DO16	16 ch – digital output module
RLY8	8 ch – relay output module
ZI	2 ch – isolated zirconia input module

19	Reserved
XXXXXX	Future

20-30	Features
NONE	No feature required

31	Future
XXXXXX	Future

32	Future
XXXXXX	Future

33-35	Communications Option
NONE	Serial Modbus TCP/RTU Ethernet Modbus/TCP

36	Future
XXXXXX	Future

37	Future
XXXXXX	Future

38	Labels
XXXXXX	No custom labels (Eurotherm)
Fnnnn	Custom label

39	Special
XXXXXX	Default

40	USB Memory Stick
NONE	Not required
008G	8GB USB memory stick

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