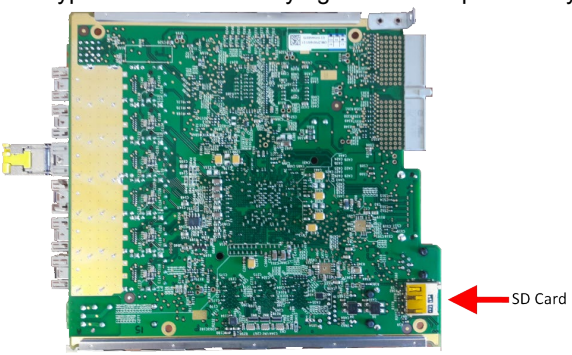
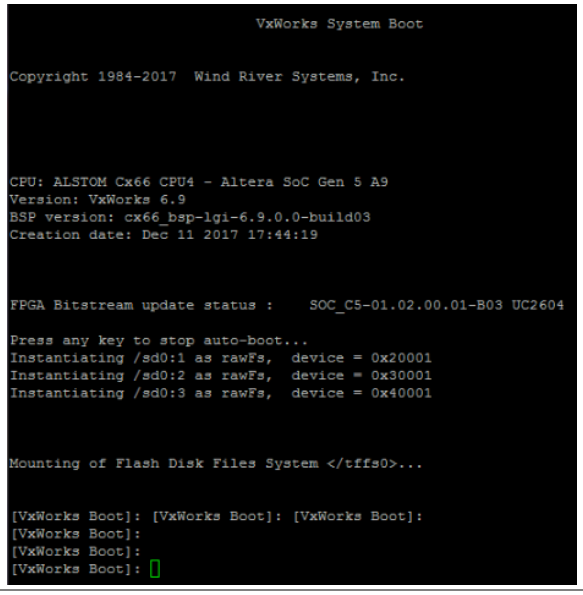
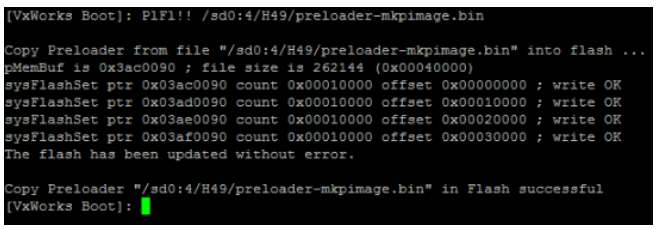
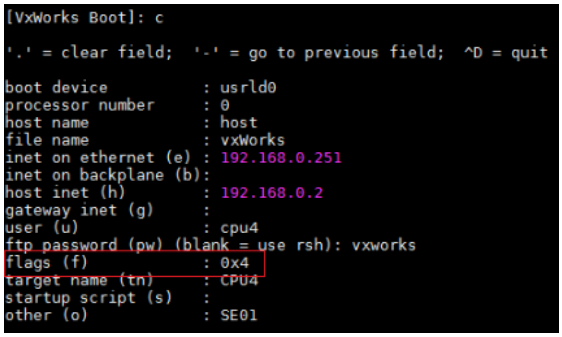
3.8.2 KEYS TO FACTORY RESET FLOW CHART

Step to Execute	Description
1	This step is necessary for prototype CPU4 boards only. Ignore this step for newly installed C264 as they are already equipped 
2	Restart the CPU4 and stop it at first count. If the SD card is recognized, instantiating shell line shall be displayed (See image above) 
3	Pay attention to the command syntax: `PlFl!! /sd0:4/H49/preloader-mkpimage.bin` It is "*PLFL*" command (where "L" letters are in lowercases). The preloader is loaded: 

Step to Execute	Description
4	In the Shell, enter the command: `c` and change the flag parameter from 0x8 to 0x4. Check that the boot device parameter is `usrld0` Here is what you should get after modification: 
5	Restart the CPU4 board doing a hard reboot. The board shall start from the SD card
6	In the shell, enter the command: `install_CPU4` LogIndus installation begins.
7	When the installation is completed, use the `c` command in the shell to set back all your IP addresses.
8	Do a hard reboot on the CPU4. Once rebooted, the logIndus version shall be installed.
9	In the shell, enter the command: `eraseFlash` It will start the flash format process.
10	Do a hard reboot on the CPU4 Your CPU4 board is now as new.
11	Now the CPU4 is empty from any configuration. Except serial, remember to connect to this CPU4 using a SAN connection (bitstream has been set to 2313 by default). If you do not use a SAN connection, the following error message may be issued from the CMT, in spite the CPU is pinging. 
12 & 13	Before reinstalling the CPU4 software from the CMT (classical installation) copy the associated certificates files into the "*CX66_cpu4*" folder. Then, launch the BootInstall by following the procedure described in the Installation chapter of the C264 user manual (section BOOTINSTALL UPDATE). The BootInstall process may take about 15 minutes per CPU4. Once BootInstall is done, reboot the CMT
14	Warning: remember the password you will need to set at the first connection (mandatory step). Default credentials: Login: `Root` Password: `Root1234#`

RECORD SHEET

C26X/EN RS/E71

Contents

1 SCOPE OF THE DOCUMENT

This document is a chapter of the DS Agile C26x documentation. It describes the Commissioning record sheet and the Maintenance Record of this unit.

The purpose of this chapter is to follow the history of the DS Agile C26x hardware replacement.

2 COMMISSIONING RECORD

Commissioning Date:

Engineer:

Station Name:

Circuit Name:

Front Plate Information

Under the top access cover, there is the following type of label:

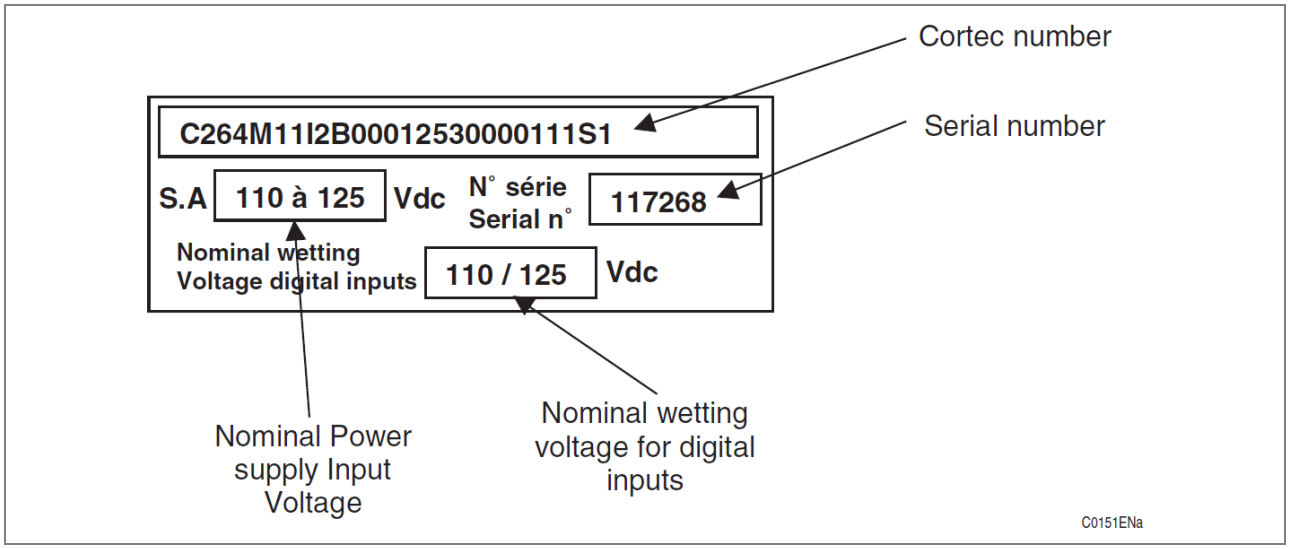


Figure 1: Front plate information

Fill in the following array according to the label under the top access cover:

Serial number	
Cortec number	
Auxiliary voltage for power supply	
Nominal wetting voltage for digital inputs	

	*Delete as appropriate
Have all relevant safety instructions been followed?	Yes/No*

Product checks

Visual inspection with the unit de-energized

Relay damaged?	Yes/No*
Rating information correct for installation?	Yes/No*
Case earth installed?	Yes/No*

3 MAINTENANCE RECORD SHEET

Product Serial number	

DATE	Engineer	Board type	Slot letter in the rack (between A and Q)	Previous board Serial number	New board Serial number
/ /					
/ /					
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TECHNICAL DATA

C26X/EN TD/E71b

Contents

1 SCOPE OF THE DOCUMENT

This document is a chapter of the DS Agile C26x documentation, listing its technical characteristics.

2 GENERAL DATA

2.1 DESIGN

In conformance with European Commission Directives:

- Electromagnetic Compatibility (EMC) 2014/30/EU
- Low voltage (LVD) 2014/35/EU

Surface-mounted case suitable for wall mounting or flush-mounted case for 19” cubicles and for control panels.

2.2 INSTALLATION POSITION

Vertical ±15°

2.3 DEGREE OF PROTECTION

In conformance with DIN VDE 0470 and standards IEC60255-27:2013 and IEC60255-26:2013:

- Protection of equipment against ingress of solid foreign objects and water (Environmental)
  - Front panel with RJ11 connector ("blind"): No claim
  - Front panel without RJ11 connector (with LCD and/or LEDs): IP2X
  - Sides for standard 40TE case: IP2X
  - Sides for ventilated 40TE and 80TE cases: No claim
  - Rear: No claim
- Protection of persons against access to hazardous parts (Safety)
  - Front panel with RJ11 connector ("blind"): IP1X
  - Front panel without RJ11 connector (with LCD and/or LEDs): IP2X
  - Sides for standard 40TE and ventilated 40TE/80TE cases: IP2X
  - Rear for standard 40TE and ventilated 40TE/80TE cases: IP1X

2.4 WEIGHT

- Standard 40TE and ventilated 40TE cases: approximately 4 kg
- Ventilated 80TE case: approximately 8 kg

2.5 DIMENSIONS AND CONNECTIONS

Please refer to the dimensional drawings (C26x/EN HW, hardware description chapter) and to the terminal connection diagrams (C26x/EN CO).

2.6 DS AGILE C26X: CONFIGURATION

The DS Agile C26x includes:

- A case
- A rack with slots for the boards
- A combination of the C26x's boards fitted in dedicated slots

There are many types of DS Agile C26x units. Each has a specific purpose and includes some combination of boards to achieve that purpose:

- C26x in 80TE case (ventilated)
- C26x in compact 40TE case (ventilated)

2.6.1 C26X – COMPARISON OF BOARD INSTALLATIONS BETWEEN MODELS

Board	Purpose	C26x 80TE	C26x 40TE
BIU261	Power supply board	X	X
CPU4	Ethernet communication channels	X	X
CCU200	Circuit breaker control unit	X	X
CCU211	Circuit breaker control unit	X	X
DIU200	Digital and counter acquisition Digital measurement acquisition Datapoints: SPS DPS SCT DCT DM	X	X
DIU211	Digital and counter acquisition Digital measurement acquisition Datapoints: SPS DPS SCT DCT DM	X	X
DIU221	Digital and counter acquisition Digital measurement acquisition Datapoints: SPS DPS SCT DCT DM	X	X
DOU201	Execution of single or dual, transient or permanent conditions Set datapoints	X	X
HBU200	Execution of single or dual, transient or permanent conditions	X	X
AIU201	Analogue measurement acquisition	X	X
AIU211	Analogue measurement acquisition	X	X
TMU210	CT and VT sampling acquisition MV calculations with acquired samples	X	X
TMU220	CT and VT sampling acquisition MV calculations with acquired samples	X	X
AOU200	Analogue output board	X	X
SRP28x	Networking	X	X
SRP29x	Networking	X	X
GHU2AB, see note 1	Graphic panel board with LED channels	GHU 2A1	GHU 2A0
Note 1: For GHU2	A B: B for the size B=B includes all possibilities: B=0 or 1 B=0 Small B=1 Large A for the LCD A=A includes all possibilities: A=0, 1, or 2 A=0 Has LCD A=1 Has no LCD A=2 Has remote LCD		

2.6.2 C26X-80TE – BOARD INSTALLATION

Board	Slots - Viewed from the rear of the case																Maximum Nr of Installed Boards	
	Q	P	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A	With TMU	Without TMU
BIU261																	X	1	1
CPU4																X		1	1
CCU200, see note 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			≤ 14	≤ 15
CCU211, see note 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			≤ 14	≤ 15
DIU200	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			≤ 14	≤ 15
DIU211	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			≤ 14	≤ 15
DIU221	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			≤ 14	≤ 15
DOU201	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			≤ 14, see note 3	≤ 15, see note 3
HBU200	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			≤ 2	≤ 2
AIU201	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			≤ 6	≤ 6
AIU211	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			≤ 6	≤ 6
TMU210, see note 1	X																	1	0
TMU220, see note 1	X																	1	0
AOU200	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			≤ 4	≤ 4
SRP28x														X	X			≤ 1	≤ 1
SRP29x														X	X			≤ 1	≤ 1
GHU2A1, see note 2																		1	1

Note 1: If you install a TMU, do not install the CCU in slot P and do not install the CCU in the slot adjacent to the TMU.

Note 2: For an explanation of the GHU2AB codes, please refer to C26x – Comparison of Board Installations Between Models

Note 3: If the application causes all of the DOs to be activated at the same time: ≤ 6

2.6.3 C26X-40TE – BOARD INSTALLATION

Board	Slots - Viewed from the rear of the case								Maximum Number of Installed Boards	
	H	G	F	E	D	C	B	A	With TMU	Without TMU
BIU2xx								X	1	1
CPU4							X		1	1
CCU200, see note 1	X	X	X	X	X	X			≤ 3	≤ 6
CCU211, see note 1	X	X	X	X	X	X			≤ 3	≤ 6
DIU200	X	X	X	X	X	X			≤ 3	≤ 6
DIU211	X	X	X	X	X	X			≤ 4	≤ 6
DIU221	X	X	X	X	X	X			≤ 4	≤ 6
DOU201	X	X	X	X	X	X			≤ 4	≤ 6
HBU200	X	X	X	X	X	X			≤ 2	≤ 2
AIU201	X	X	X	X	X	X			≤ 4	≤ 6
AIU211	X	X	X	X	X	X			≤ 4	≤ 6
TMU210, see note 1	X = 1								1	0
TMU220, see note 1	X = 1								1	0
AOU200	X	X	X	X	X	X			≤ 4	≤ 4
SRP28x					X	X			≤ 2	≤ 2
SRP29x					X	X			≤ 2	≤ 2
GHU2A0, see note 2									1	1

Note 1: If you install a TMU, do not install the CCU in slot F and do not install the CCU in the slot adjacent to the TMU.

Note 2: For an explanation of the GHU2xx codes, please refer to *C26x – Comparison of Board Installations Between Models*

2.6.4 C26X-80TE – SIGNALS

Board	Signals						Maximum Number of Boards: Maximum number of configurable signals	
	AI	AO	DI	DO	CI	VI	With TMU	Without TMU
BIU261			2	2				
CPU4								
CCU200, see note 1			8	4			13: 104 DI + 52 DO	15: 120 DI + 60 DO
CCU211, see note 1			8	4			13: 104 DI + 52 DO	15: 120 DI + 60 DO
DIU200			16				14: 224 DI	15: 240 DI
DIU211			16				14: 224 DI	15: 240 DI
DIU221			16				14: 224 DI	15: 240 DI
DOU201				10			14: 140 DO	15: 150 DO
HBU200				10			2: 20 DO	2: 20 DO
AIU201	4						6: 24 AI	6: 24 AI
AIU211	8						6: 48 AI	6: 48 AI
TMU210, see note 1	8				4	4	1: 4 CI, 4 VI	
TMU220, see note 1	9				4	5	1: 4 CI, 5 VI	
AOU200		4					6: 24 AO	6: 24 AO
SRP28x								
SRP29x								
GHU2A1, see note 2								

Note 1: Do not install the CCU in the slot adjacent to the TMU.

Note 2: For an explanation of the GHU2xx codes, please refer to *C26x – Comparison of Board Installations between Models*

2.6.5 C26X-40TE – SIGNALS

Board	Signals						Maximum Number of Boards: Maximum number of configurable signals	
	AI	AO	DI	DO	CI	VI	With TMU	Without TMU
BIU261			2	2				
CPU4								
CCU200, see note 1			8	4			3: 24 DI + 12 DO	6: 48 DI + 24 DO
CCU211, see note 1			8	4			3: 24 DI + 12 DO	6: 48 DI + 24 DO
DIU200			16				4: 64 DI	6: 96 DI
DIU211			16				4: 64 DI	6: 96 DI
DIU221			16				4: 64 DI	6: 96 DI
DOU200				10			4: 40 DO	6: 60 DO
DOU201				10			4: 40 DO	6: 60 DO
HBU200				10			2: 20 DO	2: 20 DO
AIU201	4						4: 16 AI	6: 24 AI
AIU211	8						4: 32 AI	6: 48 AI
TMU210, see note 1	8				4	4	1: 4 CI, 4 VI	
TMU220, see note 1	9				4	5	1: 4 CI, 5 VI	
AOU200		4					4: 16 AO	6: 24 AO
SRP28x								
SRP29x								
GHU2A0, see note 2								

Note 1: Do not install the CCU in the slot adjacent to the TMU.

Note 2: For an explanation of the GHU2xx codes, please refer to *C26x – Comparison of Board Installations between Models*

2.6.6 C26X: ELEMENT LIMITS

Caution:
The global performance of C26x is less than the sum of the performances of its components. For a detailed performance check, please contact us.

Caution:
The size of a C26x database, i.e. the relevant .adb file included in the .zip databag generated using DS Agile SCE must not exceed 16 MB.

Elements	Limits
BCU level capacity	Limit value
Max. electrical bays (with CTVT acquisition) using TMU210	2
Max. electrical bays (with CTVT acquisition) using TMU220	2
Max. electrical bays (with CTVT acquisition) using one TMU210 and one TMU220 in the same bay	1
Max. electrical bays (with CTVT acquisition) using IEC61850-9.2LE Sample Values (SV)	2
Nb of SV in a SampleValueGroup (eq. to electrical bay with CTVT acq.)	10
Max. SampleValueGroup(s) dedicated to one electrical bay managed by BCU	2
BCU storage features	
Event records for front panel (LHMI)	200
Event records (for CMT tool)	2048
Disturbance files generated by Fast Waveform Recorder (depending of recording time)	480 cycles max. on 1, 2, 3, 4 or 5 files
Disturbance files generated by Slow Waveform Recorder (depending of recording time)	5000 records max. on 1, 2, 5, 10, 20, 50 files
Maximum Number of analogical channels present in a disturbance file generated by Slow Waveform Recorder (3)	up to 5 current channels, up to 5 voltages channels
Maximum Number of analogical channels present in a disturbance file generated by Fast Waveform Recorder (4)	up to 5 current channels, up to 5 voltages channels
Maximum number of logical channels in a disturbance file	128
BCU Internal Ethernet switch capacity	
Max. SAN ports (without redundant ports used for PRP or HSR)	6
Max. SAN ports (with 2 redundant ports used for PRP or HSR)	4
BCU IEC61131-3 automation capacity	
Fast automation (FBD)	
Max. PSL Interlocking equations (interlock FBD) per BCU	200
Max. fast automations with at least 1 setting	29
Max. settings per fast automations	100 for 'Boolean' type, and 100 for 'timer' type
PSL operators / functions (max number of PSL lines in the BCU file, after SCE optimisation and generation)	256

Slow automation (ISAGRAF)	
Max. slow automations per BCU	256
Max. slow automations with at least 1 setting	29
Max. settings per slow automations	200
SCADA protocols	**Limit value**
SCADA communication ports	4
Admissible different SCADA protocols (ex: T104 AND T101,...)	2
Max. SCADA serial protocols (on BIU2xx serial ports)	2
T104 slave (server) protocols (with up to 4 Clients, only one server active at same time)	4
T104 slave event buffer size	5000
Station Bus level (SBUS)	**Limit value**
Station Bus communication (mandatory for conventional and digital DCS architecture)	1
Max. Station Bus servers (BCU and IEDs, for a BCU client)	150 to 250
Max. Station Bus clients (for a BCU server)	20
Maximum incoming GOOSES	96
Agency goose incoming/outgoing time (SBUS GOOSE)	< 3ms
Process Bus level (PBUS)	**Limit value**
Max. number of GOOSE Control Blocks subscribed	16
Max. number of GOOSE Control Blocks published	16
Max. independent SCUs connected to the same Bay Controller Unit	16
Max. redundant SCUs connected to the same Bay Controller Unit	8
Max. redundant Sample Value Group(s) usable by electrical bay (managed by BCU)	2 per dynamic arrangement
Max. MU connected to the same Process Bus (100Mb PBUS)	8
Max. MU connected to the same Process Bus (1Gb PBUS)	80
Max. SVCB simultaneously used on the same Sample Value Group	6
Max. subscribers acquired in same time by BCU (IEC61850-9.2LE Sample Values frames)	6
GOOSE size (IEC61850 only)	128 binary inputs / 64 measurements
Max number of subscribers acquired in same time by BCU (IEC61850-9.2LE Sample Values frames)	6
Trip goose incoming/outgoing time (PBUS GOOSE)	< 500µs
Legacy Bus level (LBUS)	**Limit value**
Master Legacy protocols (for IED communication)	4
Admissible different Legacy protocols (ex: T101 AND Mobdus...)	2
Max. Master Legacy serial protocols (on BIU2xx serial ports)	2
Max. IED per Legacy Bus basis	16
BCU Logical module(s) steady-state capacity	**Limit value**
Max. number of bays managed per Bay Controller Unit	128
Max. number of bays displayed at bay level (LHMI)	12
Max. number of circuit breakers (CB) managed per Bay Controller Unit	128
Disconnectors and earth switches (DS, ES, EF)	512
Max. number of Transformers managed per Bay Controller Unit	10
Max. number of Busbars managed per Bay Controller Unit	10
Max. number of BI managed per Bay Controller Unit (previously called "digital input points")	10000
Max. number of MPS managed per Bay Controller Unit	2000

Max. number of digital output Control Points wired on BCU and IED (SPC, DPC)	1200
Max. number of digital inputs acquired by the Bay Controller Unit boards (DI)	240
Max. number of digital outputs acquired by the Bay Controller UniTt boards (DO)	150
Max. number of analog inputs (measurements) acquired by Bay Controller Unit boards (AI)	48
Max number of analog outputs generated by the Bay Controller Unit boards (AO)	16
Max. number of analog Measurements client & Server (MV)	2400
Max. number of thresholds managed per analog measurement	6
Max. number of segments per analog measurement linearization	20
Max. number of Tap Position Indication wired on BCU and IED (TPI)	128
Max. number of SPI managed per Bay	4
Max. number of Counters wired on BCU and IED (SCT, DCT)	128
Max. number of counters wired on BCU	8*
Max. number of Setpoints wired on BCU or IED (digital or analogue)	256
Logical combination of binary inputs (BI GROUP)	512
Max. number of groups of analog measurements (xPS triggers)	16
Max. number of analog measurements in a group	16
Max. number of different units for MV / Setpoint / Counter	40
BCU Logical module(s) real time capacity	**Limit value**
Receiving flow of MV[1]	200 values /sec
Receiving flow of SPS/DPS[1]	100 state changes /sec
Total receiving flow (MV and SPS and DPS)	300 values and state changes /sec

1: the MV and SPS/DPS must not be sent to the Local HMI for the maximum performance.

2: MU = digital merging unit

3: depending of the analog measurement device (SV, TMU220, TMU210)

4: depending of the analog measurement device (SV, TMU220, TMU210), including the use case with one TMU210 and one TMU220 allocated in the same electrical bay

(*) Please refer to BCU- Pulse Counter Processing

2.7 TERMINALS

PC Maintenance Interface

- DIN 41652 connector, type female D-Sub, 9-pin, installed on the front panel
- A direct wired cable is required.

Conventional communication links

- M3 threaded terminal ends, self-centring with wire protection for conductor cross sections from 0.2 to 2.5 mm² for BIU261 board
- CPU4: Optical fibre connectors are LC-type small form-factor pluggable (SFP) transceivers that can use both single and multi-mode fibre. Centre wavelength: 1300 nm.

Input /Output or power supply modules

M3 threaded terminal ends, self-centring with wire protection for conductor cross sections from 0.2 to 2.5 mm² for these boards:

- AIU201, AIU211
- AOU200
- BIU261
- CCU200, CCU211
- DIU200, DIU211, DIU221
- DOU201
- HBU200

The I/O and BIU261 boards include a 24-pin, 5.08 mm pitch male-connector.

Current-measuring and Voltage-measuring inputs

- M5 threaded terminal ends, self-centring with wire protection for conductor cross sections between 2.5 and 4 mm² for the TMU board.
- The TMU board includes this connector: MIDOS 28 terminal block.

2.8 CREEPAGE DISTANCES AND CLEARANCES

In accordance with IEC 60255-27:2013.

Pollution degree 2, working voltage 250 V.

Overvoltage category III, impulse test voltage 5 kV.

3 RATINGS

3.1 AUXILIARY VOLTAGE

3.1.1 UNIVERSAL, SINGLE- OR DUAL-INPUT POWER SUPPLY (BIU261S/BIU261D)

The power supply input(s) of the BIU261S board and of the BIU261D dual-input power supply module are available with the following auxiliary voltage ranges:

BIU261S

Nominal ranges	Operative DC range	Operative AC range
48 to 250 V_{DC}	40.8 (48-15%) to 300 (250+20%) V_{DC}	-
110 to 250 V_{AC}	-	88 (110-20%) to 300 (250+20%) V_{AC}

BIU261D: Main power supply input

Nominal ranges	Operative DC range	Operative AC range
110 to 250 V_{DC}	88 (110-20%) to 300 (250+20%) V_{DC}	-
110 to 250 V_{AC}	-	88 (110-20%) to 300 (250+20%) V_{AC}

BIU261D: Backup power supply input (DC range only)

Nominal ranges	Operative DC range
110 to 250 V_{DC}	88 (110-20%) to 300 (250+20%) V_{DC}

Note:
The main and backup power supply inputs can use identical or different operating ranges (rating and/or AC/DC type).

The nominal frequency (f_n) for the AC auxiliary voltage is dual rated at 50/60 Hz, the operating range is 44 Hz to 66 Hz.

The BIU261 board has the following characteristics:

- Inrush current:

Power input voltage (V_{DC})	Measured peak current (A)	Power up duration (ms)
110	19.4	110
220	43.8	92

- Maximum power supply: 60 W
- Nominal output voltage: + 5 V and +12 V
- Full load permitted power outage of both power supply inputs: 20 ms
- Protection against polarity reversal
- Insulation resistance: >100 MΩ (common mode) at 500 V_{DC}
- Dielectric strength: 2 kV (common mode) – 50 Hz for 1 minute

Power supply input selection

A power supply source is considered available if its level is above 80% of the minimum value of the operative range, i.e. 80% x 48 V = 38.4 V or 80% x 110 V = 88 V. A 5% hysteresis is added in order to avoid any toggling in the availability status, i.e. the availability status will pick up at 80% $V_{AUX\ MIN}$ and drop off at 75% $V_{AUX\ MIN}$.

If the primary power supply input is lost while it is being used, the BIU261 switches to the secondary power supply input. It will switch back to the primary power supply when the latter becomes available again and has been stable for a few seconds.

If the secondary power supply is lost while it is being used, the BIU261 instantly switches to the primary power supply. It will continue to use the primary power supply source as long as it is available, even when the secondary power supply becomes available again.

3.1.2 BIU261S/BIU261D DIGITAL OUTPUTS

On the BIU261S board, as well as on the BIU261D's mother board, the characteristics of the Watchdog Relay Contacts are the same as the characteristics for the NO+NC contacts fitted on the DOU201 board.

On the BIU261S board, as well as on the BIU261D's mother board, the characteristics of the two output relays used for C26x redundancy are the same as for the single-pole output-relay fitted on the DOU201 board.

3.1.3 BIU261S/BIU261D DIGITAL INTPUTS

BIU261S/BIU264D provide two isolated logic inputs intended to be driven from the volt-free contacts on Output1 and Output2. The inputs are designed to operate from 48V DC to 250VDC (+/- 20%) allowing them to be powered by the local supply voltage.

Characteristic of the isolated inputs:

- Guaranteed Logic 0 level = 10V
- Guaranteed Logic 1 level = 38V
- Threshold Level 0 to 1 = 29V
- Threshold Level 1 to 0 = 19V
- Maximum input voltage = 300VDC

3.2 CIRCUIT BREAKER CONTROL UNIT (CCU) DIGITAL INPUTS

3.2.1 CCU200 DIGITAL INPUTS

For the CCU200 board, for the variants A01 to A04, the eight inputs have the same attributes as the inputs for the DIU200 board.

The CCU200 board is available in five nominal voltage variants, as follows:

Board variant	Nominal voltage (+/-20%)	Triggering threshold (V_{DC})	Same for DIU200
A01	24V_{DC}	if V >10.1V_{DC} Input status is set if V < 5V_{DC} Input status is reset	Yes
A02	48 to 60V_{DC}	if V >17.4V_{DC} Input status is set if V < 13.5V_{DC} Input status is reset	Yes
A03	110 to 125V_{DC}	if V > 50V_{DC} Input status is set if V< 34.4V_{DC} Input status is reset	Yes

Board variant	Nominal voltage (+/-20%)	Triggering threshold (V_{DC})	Same for DIU200
A04	220V_{DC}	if V > 108V_{DC} Input status is set if V< 63V_{DC} Input status is reset	Yes
A07	110 to 125V_{DC}	if V > 86V_{DC} input status is set if V < 67V_{DC} input status is reset	No

3.2.2 CCU211 DIGITAL INPUTS

There are six variants of the CCU211 board, as follows:

Board variant	Nominal voltage (+/-20%)	Triggering threshold (V_{DC})
A01	24 V_{DC}	if V >10 V_{DC} Input status is set if V < 8 V_{DC} Input status is reset
A02	48 to 60 V_{DC}	if V >17.4 V_{DC} Input status is set if V < 12.5 V_{DC} Input status is reset
A03	110 to 125 V_{DC}	if V > 50 V_{DC} Input status is set if V< 29.9 V_{DC} Input status is reset
A04 or A07	220 V_{DC} or 110 to 125 V_{DC} (with 80% Threshold)	if V > 86 V_{DC} Input status is set if V< 67 V_{DC} Input status is reset
A08	220 V_{DC} (with 80% Threshold)	if V > 176 V_{DC} Input status is set if V < 132 V_{DC} Input status is reset

3.3 CIRCUIT BREAKER CONTROL UNIT (CCU) DIGITAL OUTPUTS

3.3.1 CCU200 DIGITAL OUTPUTS

Each relay of the CCU board has double pole contacts. To get the attributes described below, you must wire the two output contacts of each relay in series.

In the table that follows, the Break attribute shows in two cases:

- You use each of the output contacts separately
- You wire the two output contacts of each relay in serial. In this event, you make the best use of the Break function for each relay

On the CCU200 board, the details of the 4 Output Relay Contacts show in this table:

Description	Values
Nominal operating voltage range	24 to 250 VDC / 230 VAC
Carry (steady state current)	5 A
Making capacity (rated inrush current)	5 A continuously 30 A for 500 ms or 250 A for 30 ms
Breaking capacity (Output contacts used separately)	DC: 50 W resistive, 30 W inductive (L/R = 40 ms) AC: 1250 VA resistive, 1250 VA inductive (power factor = 0.7) In these conditions, the contact resistance is still lower than 250 mΩ for 10 000 operations
Breaking capacity (Output contacts wired in serial)	DC: 80 W resistive for currents lower than 1 A, 100 W resistive for currents higher than 1 A, 30 W inductive (L/R = 40 ms) AC: 1250 VA resistive, 1250 VA inductive (power factor = 0.7) In these conditions, the contact resistance is still lower than 250 mΩ for 10 000 operations
Breaking time	< 7 ms

Description	Values
Double pole contacts	Normally open
Number of operations	Unloaded contact: > 100 000 Loaded contact: >10 000

Dielectric strength of the coil and the contacts: 5000 V_{RMS}

Dielectric strength of adjacent contacts: 2500 V_{RMS}

Isolation: 2 kV (CM) at 50 Hz for 1 minute

The board is designed and monitored to prevent any unwanted event.

3.3.2 CCU211 DIGITAL OUTPUTS

For the CCU211 board, the Digital Output (DO) attributes include:

- 4 double-pole switch-relays with normally open (NO) contacts
- 1 common +ve and 1 common -ve contact for 2 relays
- A self-monitoring device for the output control chain: address check, state monitoring
- The +5V voltage is monitored to prevent issuing an unwanted signal
- You can configure the digital outputs only in the double remote signalling configuration
- Dielectric strength of the coil and the contacts: 5000 V_{RMS}
- Dielectric strength of adjacent contacts: 2500 V_{RMS}
- The board is designed and monitored to prevent issuing an unwanted signal

In the table that follows, the Break attribute shows in two cases:

- You use each of the output contacts separately
- You wire the two output contacts of each relay in serial. In this event, you make the best use of the Break function for each relay
- For more details, please refer to the table that follows.

Description	Values
Nominal operating voltage range	24 to 250 V_{DC} / 230 V_{AC}
Carry (steady state current)	5 A
Making capacity (rated inrush current)	5 A continuously 30 A for 500 ms or 250 A for 30 ms
Breaking capacity (output contact used separately)	DC: 50 W resistive, 30 W inductive (L/R = 40 ms) AC: 1250 VA resistive, 1250 VA inductive (power factor = 0.7) In these conditions, the contact resistance is still lower than 250 mΩ for 10000 operations
Breaking capacity (Output contacts wired in serial)	DC: 80 W resistive for currents lower than 1 A, 100 W resistive for currents higher than 1 A, 30 W inductive (L/R = 40 ms) AC: 1250 VA resistive, 1250 VA inductive (power factor = 0.7) In these conditions, the contact resistance is still lower than 250 mΩ for 10 000 operations
Breaking time	< 7 ms
Double pole contacts	Normally open

Description	Values
Number of operations	Unloaded contact: > 100 000 Loaded contact: >10 000

3.4 DIGITAL INPUT UNIT (DIU) DIGITAL INPUTS

3.4.1 DIU200 DIGITAL INPUTS

The DIU200 board has 16 digital inputs and is available in four nominal voltage variants:

Board variant	Field voltage	Triggering threshold		Trigger current	Current at rated voltage	Max. power
		Pick-up	Drop-off			
A01	24 V_{DC}	10.1 V_{DC}	5 V_{DC}	>0.17 mA	3 mA	0.12 W
A02	48-60 V_{DC}	17.9 V_{DC}	13.5 V_{DC}	>0.17 mA	5.22 mA (48 V_{DC})/ 7 mA (60 V_{DC})	0.66 W
A03	110-125 V_{DC}	52.3 V_{DC}	34.4 V_{DC}	>0.33 mA	2.6 mA (110 V_{DC})/ 3.5 mA (125 V_{DC})	0.62 W
A04	220 V_{DC}	108 V_{DC}	63 V_{DC}	>0.46 mA	2 mA	0.66 W

3.4.2 DIU211 DIGITAL INPUTS

In the C26x case, the DIU211 board can replace a DIU200 board. The external connections are the same as for these boards.

The DIU211 board includes 16 opto-isolated digital-inputs, with one common for two inputs.

Warning:
Where digital inputs are energized at 300 V the C26x ambient operating temperature is limited to 40°C and the maximum number of simultaneously energized digital inputs must not exceed 50% per DIU211 module.

The inputs are suitable for use on systems with nominal battery voltages from 24 V_{DC} to 220 V_{DC} (+/- 20%). The inputs respond to negative input voltages. The inputs are not self-checked. The threshold voltage depends on the voltage range which is set by positioning a jumper on the board (see *Hardware* chapter):

Variant	Input voltage	Triggering threshold		Trigger current	Current at rated voltage	Rated power
		Pick-up	Drop-off			
A01	24 V_{DC}	10 V_{DC}	8 V_{DC}	30 mA for 2 ms	3.2 mA	0.077 W
A02	48 V_{DC} – 60 V_{DC}	17.4 V_{DC}	12.5 V_{DC}	30 mA for 2 ms	2.9 mA at 48 V	0.14 W
A03	110 V_{DC} – 125 V_{DC}	50 V_{DC}	29.9 V_{DC}	30 mA for 2 ms	2.4 mA at 110 V	0.26 W
A04	220 V_{DC}	86 V_{DC}	67 V_{DC}	30 mA for 2 ms	1.9 mA	0.42 W
A07	110 V_{DC} – 125 V_{DC} with 80% threshold	86 V_{DC}	67 V_{DC}	30 mA for 2 ms	2.4 mA at 110 V	0.26 W
A08	220 V_{DC} with 80% threshold	176 V_{DC}	132 V_{DC}	30 mA for 2 ms	1.9 mA	0.42 W

For an input voltage from the threshold value to 18 V, the input current is 30 mA. The voltage applied to the input terminals, with an amplitude between 19 V_{DC} and 264 V_{DC} powers the pulse generation circuit. The circuit drives a current pulse with an amplitude of 30 mA. The pulse duration is between 1 ms and 2 ms.

To reduce thermal dissipation, especially at high input voltages, the inputs draw a current of less than 1.6 mA.

A high current circulation inside binary contacts for a short period cleans them and thus allows the boards to be used in contaminated environments.

3.4.3 DIU221 DIGITAL INPUTS

In the C26x case, the DIU221 board can replace a DIU200 board or a DIU211 board. The external connections are the same as for these boards.

The DIU221 board includes 16 galvanically isolated (40 kΩ) digital inputs, with one common for two inputs.

The inputs are suitable for use on systems with nominal battery voltages of 158-170 V_{DC} (A09 variant) or 250 V_{DC} ±20% (A10 variant). The inputs do not respond to negative input voltages. The inputs are not self-checked.

Variant	Input voltage	Triggering threshold	
		Pick-up	Drop-off
A09	170 V_{DC}	170 V_{DC}	154 V_{DC}
A10	250 V_{DC}	200 V_{DC}	150 V_{DC}

The voltage applied to the input terminals powers the pulse generation circuit. The circuit drives a high-current "rejection" pulse with an amplitude of up to 140 mA. The pulse duration is approximately 3 ms. It carries an electric charge of at least 200 µC. It allows the boards to be used in contaminated environments by burning off possible deposits on the contacts.

In order to reduce thermal dissipation, the 40 kΩ resistance is switched off when the input voltage level crosses the pick-up threshold.

The rejection pulse is allowed to fire only once every 4 seconds in order to prevent the risk of component damage. It is fired before the input channel turns on. By the time it has finished, the voltage has continued to rise enough to cross the input pick-up threshold and the 40 kΩ resistance is switched off.

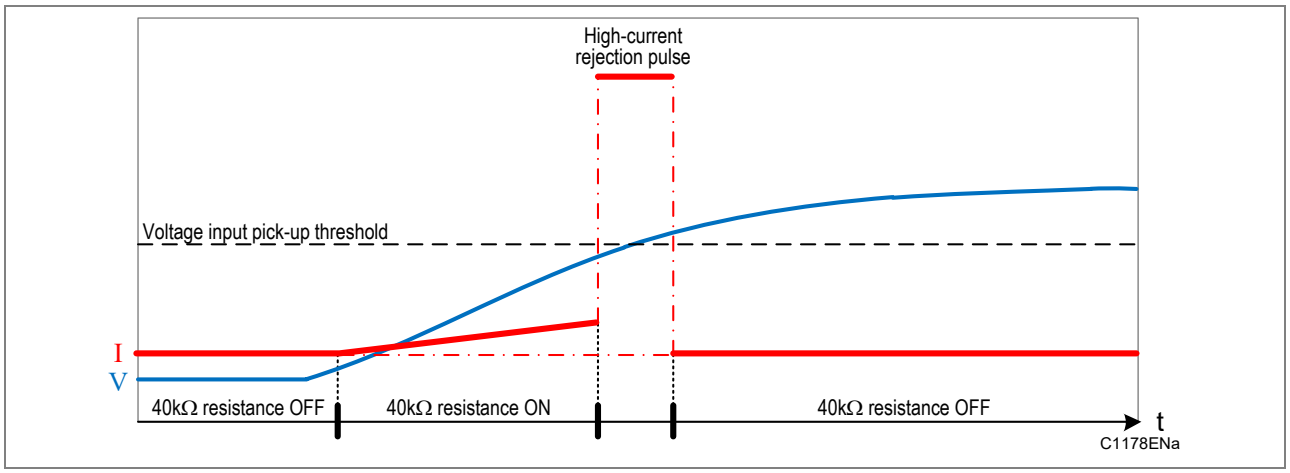

Figure 1: Input channel response curve

3.5 DIGITAL OUTPUT UNIT (DOU) DIGITAL OUTPUTS

3.5.1 DOU201 DIGITAL OUTPUTS

The DOU201 board provides:

- 10 insulated digital outputs (with relays)
- 8 single pole relays with one normally open (NO) contact
- 2 double pole relays with 1 common for 2 output contacts (NO/NC changeover)

External connections remain the same as for earlier versions of the board.

The characteristics of the output relay contacts of a DOU201 board are given in this table:

Description	Values
Nominal operating voltage range	24 to 250 V_{DC} / 230 V_{AC}
Carry (steady state current)	5 A
Making capacity (rated inrush current)	5 A continuously 30 A for 500 ms (open for 40 s afterwards) or 250 A for 30 ms
Making time	< 7 ms
Breaking capacity	Breaking capacity for 100 000 operations: DC: 150 W resistive, 15 W inductive (L/R = 20 ms) AC: 1500 VA resistive, Breaking capacity reduced to 90 000 operations: AC: 1500 VA inductive (power factor = 0.7) Breaking capacity confirmed after 10 000 operations (contact resistance still lower than 250 mΩ): DC: 30 W inductive (L/R = 40 ms)
8 single-pole relays	Normally open contacts
2 double-pole relays	1 common for 2 output contacts (NO/NC changeover)
Number of operations	Unloaded contact: > 100 000 Loaded contact: >10 000

The location of the DOU201 in the C26x rack defines the address of the board. If you use the DOU201 as a spare of a previous board, you can use the jumper to define the address of the board. Use the SCE to define this location (refer to C26x/EN AP).

- Dielectric strength of the coil and the contacts: 5000 V_{AC}.
- Isolation: 2 kV (CM) at 50 Hz for 1 minute
- The board is designed and monitored to prevent issuing an unwanted signal.

3.6 HIGH BREAK UNIT (HBU) HIGH BREAK/HIGH SPEED DIGITAL OUTPUTS

The HBU200 board is used for applications requiring high rupture capacity. It provides 10 single pole output relays with normally open (NO) contacts.

The characteristics of the output relay contacts of an HBU200 board are given in this table:

Description	Values
Nominal operating voltage range	up to 250 V_{DC} / 250 V_{AC} + 20%
Transient impulse clamping level	450 V minimum
Carry (steady state current)	Single pole: 10 x 10 A at 55°C Double pole: 5 x 16 A at 40°C
Making capacity (rated inrush current)	33 A for 3 s
Maximum inrush current	100 A for 30 ms
Making time	< 0.5 ms
I^2t rating	300 A^2/s

Description	Values
Contact resistance	Make: 33 mΩ Carry: 10 mΩ
Breaking capacity	Breaking capacity for 10 000 operations: DC: 7500 W resistive, 2500 W inductive (L/R = 40 ms) AC: 7500 W resistive, 2500 W inductive
Number of operations	Unloaded contact: > 100 000 Loaded contact: >10 000

The location of the HBU200 board in the C26x rack defines the address of the board. . If you use the HBU200 as a spare of a previous board, you can use the jumper to define the address of the board. Use the SCE to define this location (refer to C26x/EN AP).

- Isolation: 2 kV (CM) at 50 Hz for 1 minute, 4 kV impulse
- The board is designed and monitored to prevent issuing an unwanted signal.

3.7 ANALOGUE INPUT UNIT (AIU) ANALOGUE INPUTS

3.7.1 AIU201 ANALOGUE INPUTS

The AIU201 board provides 4 independent analogue inputs (AI). You can set each AI input current range or input voltage range as shown in the table that follows:

Type	Ranges
Current input range	[–1 mA .. +1 mA] [–5 mA .. +5 mA] [–10 mA .. +10 mA] [–20 mA .. +20 mA] (see C26x/EN AP for settable sensor ranges)
Voltage input range	[–1.25 V .. +1.25 V] [–2.5 V .. +2.5 V] [–5 V .. +5 V] [–10 V .. +10 V]
Sampling period	100 ms
Accuracy	0.1% full scale at 25°C
AD conversion	16 bits (15 bits + sign bit)
Common mode rejection ratio (CMMR)	> 100 dB
Serial mode rejection ratio (SMMR)	> 40 dB
Range of Gain: user-selectable	1, 2, 4, 16
Input impedance for voltage inputs	11 kΩ
Input impedance for current inputs	75 Ω

You can set the ranges during the configuration phase.

To select the current or voltage, choose the input number of the connector.

AD conversion

The zero offset value is computed by the conversion of a 0 V voltage reference.

The gain is adjusted automatically by software by connecting a known voltage reference to the amplifier.

The zero offset values and the gain are adjusted regularly in order to compensate for the deviations caused by variations of temperature (drift: as much as 30 ppm/°C) and ageing.

3.7.2 AIU211 ANALOGUE INPUTS

Transducers deliver the DC current signals to the AIU211 board. The AIU211 board provides 8 insulated analogue input values on 8 independent galvanic-isolated channels. This means that there is no common point of contact between two analogue inputs.

You can configure each analogue input in the current range as shown in the table that follows:

Type	Ranges
Current input range	[–1 mA .. +1 mA] [–5 mA .. +5 mA] [–10 mA .. +10 mA] [–20 mA .. +20 mA] (see AP chapter for settable sensor ranges)
Sampling period	100 ms
Accuracy	0.1% full scale for each range at 25°C
AD conversion	16 bits (15 bits + sign bit)
Common mode rejection ratio (CMMR) 50Hz, 60Hz	> 100 dB
Serial mode rejection ratio (SMMR)	> 40 dB
Input impedance for current inputs	75 Ω

Temperature drift: as much as 30 ppm/°C between 0°C and 70°C

You can set the ranges during the configuration phase.

To select the current range, choose the input number of the connector.

The AIU211 board replaces the AIU210 Board: the interface on the internal Bus is compatible with the AIU210.

3.7.3 SATURATION VALUES

Range	Saturation values
[–10 V .. +10 V]	-12.6 V / +12.6 V
[–5 V .. +5 V]	-6.3 V / +6.3 V
[–2.5 V .. +2.5 V]	-3.2 V / +3.2 V
[–1.25 V .. +1.25 V]	-1.26 V / +1.26 V
[–1 mA .. +1 mA]	-1.26 mA / +1.26 mA
[–5 mA .. +5 mA]	-6.3 mA / +6.3 mA
[–10 mA .. +10 mA]	-12.6 mA / +12.6 mA
[–20 mA .. +20 mA]	-25.2 mA / +25.2 mA

3.8 TRANSDUCERLESS MEASUREMENT UNIT (TMU) CT/VT ANALOGUE INPUTS

3.8.1 GENERAL

For C26x BCUs, you can install TMU210, and TMU220 boards.

The TMU220 provides 4 Current Transformer (CT) inputs & 5 Voltage Transformer (VT) inputs.

The TMU210 provides 4 Current Transformer (CT) inputs & 4 Voltage Transformer (VT) inputs.

3.8.2 TMU220 – CURRENT TRANSFORMERS (CT)

On the terminal block, there are two available nominal currents, each with different attributes.

The current measurement inputs to each of the 4 Current Transformers (CT) include the following attributes:

Description	Operating range	
	1 A	5 A
Nominal AC current (In)	1 A_{RMS}	5 A_{RMS}
Minimum measurable current with same accuracy	0.2 A_{RMS}	0.2 A_{RMS}
Maximum measurable continuous current	4 A_{RMS} (4*In)	20 A_{RMS} (4*In)
Frequency	50 or 60 Hz ± 10%	50 or 60 Hz ± 10%

TMU220 CT overload withstand:

Duration	Strength	
	1 A	5 A
3 seconds: not measurable, with no destruction	6 A_{RMS} (6*In)	30 A_{RMS} (6*In)
1 second: not measurable, with no destruction	20 A_{RMS} (20*In)	100 A_{RMS} (20*In)

3.8.3 TMU220 – VOLTAGE TRANSFORMERS (VT)

The voltage measurement inputs to each of the 5 Voltage Transformers (VT) include the following attributes:

Description	Operating range
Nominal AC voltage (Vn) range	57.73 V_{RMS} to 270 V_{RMS}
Minimum measurable voltage	7 V_{RMS}
Maximum continuous, measurable voltage	300 V_{RMS}
Frequency operating range	50 or 60 Hz ± 10%

VT overload withstand:

Duration	Strength
10 seconds with no destruction	880 V_{RMS}

3.8.4 TMU210 – PROTECTIVE CURRENT TRANSFORMERS (CT)

On the terminal block, there are two available nominal currents: 1A and 5A. Each has different attributes. Use jumpers to set the 1A or 5A nominal current (refer to the block diagram, in the connection chapter).

The current measurement inputs to each of the 4 Current Transformers (CT) include the following characteristics:

I PHASE		
Standard values for rated secondary current (In)	**1A**	**5A**
Minimal current validity threshold (with upper threshold hysteresis of 2mA)	0.05A_{eff}	0.05A_{eff}
Minimal operating current*	0,1A_{eff}	0,5Aeff
Rated continuous thermal value*	4A_{eff} (400%)	20A_{eff} (400%)
Maximal operating currents*	30A_{eff} / 10s 40A_{eff} / 5s	150A_{eff} / 10s 200A_{eff} / 5s
Rated short-time thermal value**	100A_{eff} / 1s	500A_{eff} / 1s
Rated frequency range	50 or 60Hz ±10% (45 to 66 Hz)	
Consumption	<0.007VA at In	<0.144VA at In

I SENSIBLE		
Standard values for rated secondary current (Ien)	**1A**	**5A**
Minimal current validity threshold (with upper threshold hysteresis of 2mA)	0.01A_{eff}	0.05A_{eff}
Minimal operating current*	0,01A_{eff}	0,05A_{eff}
Rated continuous thermal value*	0.8A_{eff} (80%)	4A_{eff} (80%)
Maximal operating current*	8A_{eff} / 10s	40A_{eff} / 10s
Rated short-time thermal values**	30A_{eff} / 10s 100A_{eff} / 1s	150Aeff / 10s 500A_{eff} / 1s
Rated frequency range	50 or 60Hz ±10% (45 to 66 Hz)	
Consumption	< 500µVA at 0.1In	< 500µVA at 0.1In

I VERY SENSIBLE		
Standard values for rated secondary current (Ien)	**1A**	**5A**
Minimal current validity threshold (with upper threshold hysteresis of 2mA)	0,002A_{eff}	0,01A_{eff}
Minimal operating current*	0,002A_{eff}	0,01A_{eff}
Rated continuous thermal value*	0.01A_{eff} (1%)	0.05A_{eff} (1%)
Maximal operating current*	1A_{eff} / 10s	5A_{eff} / 10s
Rated short-time thermal values**	30A_{eff} / 10s 100A_{eff} / 1s	150A_{eff} / 10s 500A_{eff} / 1s
Rated frequency range	50 or 60Hz ±10% (45 to 66 Hz)	
Consumption	< 500µVA at 0.1In	< 500µVA at 0.1In

** at full scale value, rated frequency (Fn) and into operating temperature range*

*** not measurable without destruction*

3.8.5 TMU210 – PROTECTIVE VOLTAGE TRANSFORMERS (VT)

The 3 or 4 phase voltage measurement inputs to each of the 4 Voltage Transformers (VT) include the following characteristics:

Voltage Transformer (VT)	
Standard values for rated secondary voltage (Vn)	100V/$\sqrt{3}$, 100V/3, 100V, 110V/$\sqrt{3}$, 110V/3, 110V, up to 130 V_{eff}
Minimal voltage validity threshold (with upper threshold hysteresis of 1.0V)	1,0 V_{eff}
Minimal operating voltage*	5,7 V_{eff}
Rated continuous thermal value*	110V_{eff} (190%)
Maximum operating voltage	260 V_{eff} / 10s
Rated short-time thermal values**	338 V_{eff} / 10s
Consumption	<0,08VA at 57.7V <0,4VA at 130V <1.5VA at 260V
Rated frequency range	50 or 60Hz ±10% (45 to 66 Hz)

** at full scale value, rated frequency (Fn) and into operating temperature range*

*** not measurable without destruction*

Connection option by setting:

For 3 phase voltage input: 3Vpn / 2 Vpn + Vr / 2Vpp + Vr

For 4 phase voltage input: 3Vpn / 3 Vpn + Vr / 2 Vpn + Vr / 3 Vpp + Vr / 2 Vpp + Vr

All voltage and power phase protection are done on Vpp voltage directly measured or derived, and Vr is directly measured or derived.

3.8.6 TMU2XX - A/D CONVERTER

On the TMU2xx boards, the A/D converter includes the following attributes:

Description	Values
Width	16 bits
Conversion period	< 30 µs
Scanning period	80 samples/cycle
Linearity error	± 2 LSB
SINAD ratio as much as 1kHz	>80 db
Low passed filter at 1kHz	-40 db/decade

3.9 ANALOGUE OUTPUT UNIT (AOU)

3.9.1 AOU200 ANALOGUE OUTPUTS

The AOU200 board provides 4 analogue current outputs. Each output is related to a Read Inhibit relay. An external power supply supplies power to the outputs.

The analogue outputs, the relays and the power supply are one isolated group.

The external power supply must supply a regulated voltage of +48V±5% and a power of 10 W for each AOU200 board

For the AOU200 board, the output attributes are as follows:

Value	Maximal Impedance
± 5 mA (± 20% ⇨ ± 6 mA)	4 kΩ
± 10 mA (± 20% ⇨ ± 12 mA)	2 kΩ
± 20 mA (± 20% ⇨ ± 24 mA)	1 kΩ
+ 4 mA to +20 mA	

After calibration, and at 25°C, precision = 0.1% X (the full scale + 20%)
Between -10°C and +70°C, maximum deviation <100ppm/°C

100 ms after the command, the current output is stable. The management of the AOU200 board with an RI relay shows in the figure below. When the RI relay is in the closed position, you can read the value.

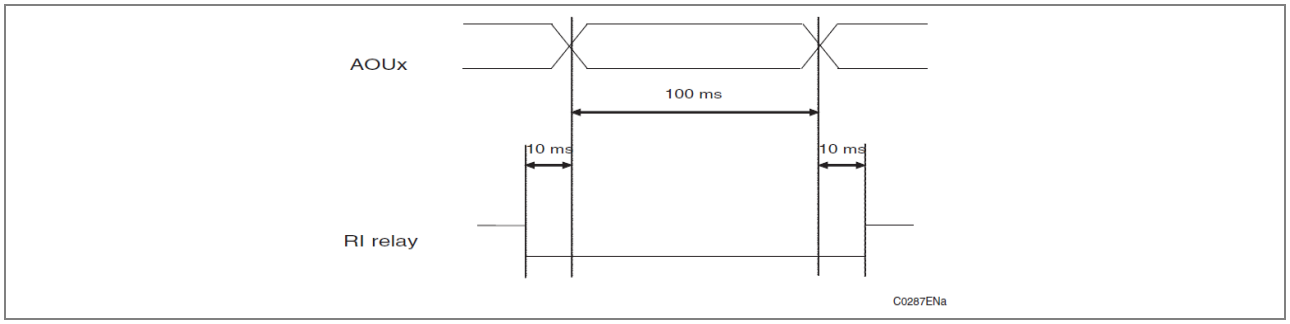

Figure 2: AOU board management with an RI relay

Watchdog relay and RI relays characteristics:

Contact type	NO
Max operating voltage	250 V_{DC} / 230 V_{AC}
Make and Carry	2.5 A continuously 30 A for 500 ms 100 A for 30 ms
Break	DC: 50 W resistive, 15 W inductive (L/R = 40 ms) AC: 1250 VA resistive 1250 VA inductive (power factor cosφ = 0.7 – relay duration is lower)
Operating time	< 7ms
Maximum frequency of switching	360 operations each hour, on nominal load
Life Period	100 000 operations, on resistive load at 250 V_{AC}, 8 A

The watchdog feature is used to send an alarm signal in case of an AOU200 board failure: This signal is sent (alarm) if:

- the automatic cyclical refresh (“I’m alive” periodic signal from the CPU, part of the communication protocol) of the WD function is interrupted, or
- communications with the CPU board are no longer possible, or
- the field voltage used by the analogue outputs is lost.

The associated green LED is lit when there is no alarm present.

3.10 TABLE OF DIELECTRIC STRENGTHS & INDEPENDENT CIRCUITS

How to read the table.

Column 2 (Type of Terminals), each line defines an independent circuit or independent circuit group.

Type of Board	Type of Terminals (Numbers of Terminals)	Dielectric Withstand (CM, 60s)
BIU261 (ZP0027001)	Digital Outputs (1 to 3) Watchdog (4 to 6) Digital Inputs (7 to 9) RS232/RS485 (12 to 21) Main Power Supply (23, 24)	2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC}
BIU261 Daughter Board (ZP0028001)	Backup Power Supply (1, 2)	2000V_{AC} 2800V_{DC}
CPU4 (ZP0063001→ZP0016001)	Alarm (1 to 3)	2000V_{AC} 2800V_{DC}
AIU201 (2070913)	Analog Inputs (1 to 5) Analog Inputs (7 to 11) Analog Inputs (13 to 17) Analog Inputs (19 to 23)	2800V_{DC} 2800V_{DC} 2800V_{DC} 2800V_{DC}
AIU211 (2071652)	Analog Inputs (1 to 2) Analog Inputs (3 to 4) Analog Inputs (7 to 8) Analog Inputs (9 to 10) Analog Inputs (13 to 14) Analog Inputs (14 to 16) Analog Inputs (19 to 20) Analog Inputs (21 to 22)	2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC}
AOU200 (2071441)	Ext. Power (1,3) Analog Outputs (17 to 24) Watchdog (5, 6) Read Inhibit AO no. 1 to 4 (8 to 15)	2800V_{DC} 2000V_{AC} 2000V_{AC}
DIU200 (45196503A1-A4) DIU211 (ZP0011001) DIU221 (ZP0062001)	2x Digital Inputs (1 to 3) 2x Digital Inputs (4 to 6) 2x Digital Inputs (7 to 9) 2x Digital Inputs (10 to 12) 2x Digital Inputs (13 to 15) 2x Digital Inputs (16 to 18) 2x Digital Inputs (19 to 21) 2x Digital Inputs (22 to 24)	2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC} 2000V_{AC} 2800V_{DC}

Type of Board	Type of Terminals (Numbers of Terminals)	Dielectric Withstand (CM, 60s)
DOU201 (2071730A01)	Digital Output (1 to 2)	2000V_{AC} 2800V_{DC}
	Digital Output (3 to 4)	2000V_{AC} 2800V_{DC}
	Digital Output (5 to 6)	2000V_{AC} 2800V_{DC}
	Digital Output (7 to 8)	2000V_{AC} 2800V_{DC}
	Digital Output (9 to 10)	2000V_{AC} 2800V_{DC}
	Digital Output (11 to 12)	2000V_{AC} 2800V_{DC}
	Digital Output (13 to 14)	2000V_{AC} 2800V_{DC}
	Digital Output (15 to 16)	2000V_{AC} 2800V_{DC}
	Digital Outputs (19 to 21)	2000V_{AC} 2800V_{DC}
	Digital Outputs (22 to 24)	2000V_{AC} 2800V_{DC}
CCU200 (45196501A1-A7) CCU211 (2071732)	2x Digital Inputs (1 to 3)	2000V_{AC} 2800V_{DC}
	2x Digital Inputs (4 to 6)	2000V_{AC} 2800V_{DC}
	2x Digital Inputs (7 to 9)	2000V_{AC} 2800V_{DC}
	2x Digital Inputs (10 to 12)	2000V_{AC} 2800V_{DC}
	2 x Digital Outputs (13 to 18)	2000V_{AC} 2800V_{DC}
	2 x Digital Outputs (19 to 24)	2000V_{AC} 2800V_{DC}
HBU200 (ZP0026001)	High Break Output (1 to 2)	2000V_{AC} 2800V_{DC}
	High Break Output (3 to 4)	2000V_{AC} 2800V_{DC}
	High Break Output (6 to 7)	2000V_{AC} 2800V_{DC}
	High Break Output (8 to 9)	2000V_{AC} 2800V_{DC}
	High Break Output (11 to 12)	2000V_{AC} 2800V_{DC}
	High Break Output (13 to 14)	2000V_{AC} 2800V_{DC}
	High Break Output (16 to 17)	2000V_{AC} 2800V_{DC}
	High Break Output (18 to 19)	2000V_{AC} 2800V_{DC}
	High Break Output (21 to 22)	2000V_{AC} 2800V_{DC}
	High Break Output (23 to 24)	2000V_{AC} 2800V_{DC}
SWR212 SWR214 (ZP0021001-2)	4 x Ethernet Port (ports pins 1 to 8)	1500V_{DC}
	Alarm (1 to 3)	2000V_{AC} 2800V_{DC}
SWU20x (2070745A01-A05)	4 x Ethernet Port (ports pins 1 to 8)	1500V_{DC}
	Alarm (1 to 3)	2000V_{AC} 2800V_{DC}
SWT214 (ZP0032001)	4 x Ethernet Port (ports pins 1 to 8)	1500V_{DC}
	Alarm (1 to 3)	2000V_{AC} 2800V_{DC}
SRP282 SRP284 (ZP0020001→ZP0015001) SRP292 SRP294 (ZP0059001→ZP0015003)	3 x Ethernet Port (ports pins 1 to 8)	1000V_{AC} 1500V_{DC}
	Alarm (1 to 3)	2000V_{AC} 2800V_{DC}
	IRIG-B (1,2)	2000V_{AC} 2800V_{DC}
DPU282 DPU284 (ZP0020002→ZP0015001)	3 x Ethernet Port (ports pins 1 to 8)	1000V_{AC} 1500V_{DC}
	Alarm (1 to 3)	2000V_{AC} 2800V_{DC}
SVU282 SVU284 (ZP0020004→ZP0015001)	3 x Ethernet Port (ports pins 1 to 8)	1000V_{AC} 1500V_{DC}
	Alarm (1 to 3)	2000V_{AC} 2800V_{DC}
	IRIG-B (1,2)	2000V_{AC} 2800V_{DC}

Type of Board	Type of Terminals (Numbers of Terminals)	Dielectric Withstand (CM, 60s)
TMU210 (2071469A01-A03) TMU220 (2071613A01)	Current Input (1 to 4)	$2000V_{AC}$ $2800V_{DC}$
	Current Input (5 to 8)	$2000V_{AC}$ $2800V_{DC}$
	Current Input (9 to 12)	$2000V_{AC}$ $2800V_{DC}$
	Current Input (13 to 16)	$2000V_{AC}$ $2800V_{DC}$
	Voltage Input (19 to 20) – TMU220 *Only*	$2000V_{AC}$ $2800V_{DC}$
	Voltage Input (21 to 22)	$2000V_{AC}$ $2800V_{DC}$
	Voltage Input (23 to 24)	$2000V_{AC}$ $2800V_{DC}$
	Voltage Input (25 to 26)	$2000V_{AC}$ $2800V_{DC}$
	Voltage Input (27 to 28)	$2000V_{AC}$ $2800V_{DC}$

4 BURDENS

4.1 POWER SUPPLY BOARD/MODULE

4.1.1 MAXIMUM MEASURED BURDEN FOR BIU261 POWER SUPPLY

Item	Power Supply Voltage	VA (VA)
Maximum burden AC powered on main power supply	110 Vac	73.2
Maximum burden AC powered on main power supply	220 Vac	84.3
Maximum burden DC powered on main power supply	110 Vdc	38.3
Maximum burden DC powered on secondary power supply	110 Vdc	36.8
Maximum burden DC powered on main power supply	220 Vdc	39.2
Maximum burden DC powered on secondary power supply	220 Vdc	38.3

4.1.2 BURDEN FOR BINARY INPUT

Power Input Voltage (V_{DC})	Measured max Value (W)
110	0.16
220	0.69

4.2 CIRCUIT BREAKER CONTROL UNITS (CCU) INPUT BURDENS

4.2.1 BURDEN FOR BINARY INPUT

On the CCU211 board, the binary input burdens are as follows:

Power input voltage (V_{DC})	Measured maximum value (W)
48	0.27
60	0.33

4.3 DIGITAL INPUT UNIT (DIU) INPUT BURDEN

4.3.1 DIU200 INPUT BURDEN

On the DIU200 board, the input burdens are as follows:

Voltage level	Maximum Power For 1 input	Maximum Power For 16 inputs	Maximum Power For 4/5/6 boards	Maximum Power For 15 boards
24 V_{DC}	0.03 W	0.23 W	0.93 W / 1.15 W / 1.38 W	3.5 W
48 V_{DC}	0.04 W	0.6 W	2.3 W / 2.9 W / 3.5 W	8.7 W
60 V_{DC}	0.17 W	1.3 W	5.3 W / 6.6 W / 7.9 W	19.8 W
110 V_{DC}	0.33 W	2.7 W	10.6 W / 13.2 W / --	39.6 W
225 V_{DC}	0.4 W	3.2 W	12.7 W / -- / --	47.6 W

4.3.2 DIU211 BINARY INPUT BURDEN

To reduce thermal dissipation, especially at high input voltage levels, the inputs use less than 1.6 mA.

The DIU211 board includes the following input burdens:

Voltage level	Maximum Power For 1 input	Maximum Power For 8 inputs	Maximum Power For 4/5/6 boards	Maximum Power For 15 boards
19.2 V_{DC}	0.03 W	0.23 W	0.93 W / 1.15 W / 1.38 W	3.5 W
48 V_{DC}	0.07 W	0.6 W	2.3 W / 2.9 W / 3.5 W	8.7 W
110 V_{DC}	0.17 W	1.3 W	5.3 W / 6.6 W / 7.9 W	19.8 W
220 V_{DC}	0.33 W	2.7 W	10.6 W / 13.2 W / --	39.6 W
264 V_{DC}	0.4 W	3.2 W	12.7 W / -- / --	47.6 W

4.3.3 DIU221 BINARY INPUT BURDEN

The DIU221 board includes the following binary input burdens:

Voltage level	Maximum Power For 1 input	Maximum Power For 8 inputs	Maximum Power For 4/5/6 boards	Maximum Power For 15 boards
19.2 V_{DC}	0.03 W	0.23 W	0.93 W / 1.15 W / 1.38 W	3.5 W
48 V_{DC}	0.07 W	0.6 W	2.3 W / 2.9 W / 3.5 W	8.7 W
110 V_{DC}	0.17 W	1.3 W	5.3 W / 6.6 W / 7.9 W	19.8 W
220 V_{DC}	0.33 W	2.7 W	10.6 W / 13.2 W / --	39.6 W
264 V_{DC}	0.4 W	3.2 W	12.7 W / -- / --	47.6 W

4.4 TRANSDUCERLESS MEASUREMENT UNIT (TMU) CT/VT INPUT BURDEN

For the TMU210 / TMU220 boards, the input burdens on the internal transformers are as follows:

CT burden (at nominal current – In)	Nominal consumption (VA)	
	TMU210	TMU220
1 A	< 0.02	< 0.02
5 A	< 0.2	< 0.2
VT burden (at nominal voltage – Vn)	**Nominal consumption (VA)**	
	TMU210	TMU220
Vn = 130 VRMS	< 0.1	< 0.01

TMU210 board:

The input burden on the internal 5 V rail is 0.3 W.

TMU220 board:

The input burden on the internal 5 V rail is 0.3 W.

5 ACCURACY

To secure the proper accuracy for calculations, the sampling frequency must be exactly adapted to the signal frequency that fluctuates around the basic frequency (50 / 60 Hz).

For all specified accuracy, the repeatability is ± 2.5% unless otherwise specified.

If no range is specified for the validity of the accuracy, then the specified accuracy is valid over the full setting range.

5.1 REFERENCE CONDITIONS

Quantity	Reference conditions	Test tolerance
General		
Ambient temperature	20 °C	±2 °C
Atmospheric pressure	86kPa to 106kPa	-
Relative humidity	45 to 75 %	-
Input energising quantity		
Current	In	±5%
Voltage	Vn	±5%
Frequency	50 or 60Hz	±0.5%
Auxiliary supply	48-250V_{DC} 110-250V_{AC}	±5%

5.2 MEASUREMENT ACCURACY

5.2.1 TMU220 - MEASUREMENT ACCURACY

Measurement	Accuracy
Current (with measurement CT)	0.2% full scale
Voltage (with voltage droppers)	0.2% full scale
Power (with measurement CT)	0.5% at best
Frequency	± 0.014 Hz
Amplitude	< 1%
Phase	± 1°
Overall temperature coefficient	± 10 ppm/°C
Harmonics	H15

5.2.2 TMU210 - MEASUREMENT ACCURACY

Measurement	Accuracy
Current accuracy	± 0.5% typical*
standard accuracy classes for protective current transformers	5VA cl. 1 (acc. IEC61869-2:2012)
Voltage accuracy	± 0.5% typical*
standard accuracy classes for protective voltage transformers	5VA cl. 1 (acc. IEC 61869-3:2011)
Absolute phase accuracy	1° (60')*
Operating temperature range	-25°C - +55°C

** at full scale value, rated frequency (Fn) and into operating temperature range*

5.3 PROTECTION ACCURACY

5.3.1 TMU210 – PROTECTION ACCURACY

Measurement	Value
Current threshold accuracy	± 1%*
standard accuracy classes for protective current transformers	5VA cl. 5P (acc. IEC 61869-2:2012)
Absolute phase current accuracy	± 1° (60')*
Voltage threshold accuracy	± 3%*
standard accuracy classes for protective voltage transformers	5VA 3P (acc. IEC 61869-3:2011)
Absolute phase voltage accuracy	± 2° (120')*

** at full scale value, rated frequency (Fn) and into operating temperature range*

5.4 COMPOUNDED POWER VALUES ACCURACY

5.4.1 TMU210 – COMPOUNDED POWER VALUES ACCURACY

Compounded value for Synchrocheck	Value
Compounded values accuracy	< 2 %*
Phase difference (computed Δφ value)	± 2° *

Active Power		Reactive Power	
Cos	Deviation	Sin	Deviation
0.866	< 1.5%*	0.866	< 3%*
0.5	< 3%*	0.5	< 1.5%*

** at full scale value, rated frequency (Fn) and into operating temperature range*

5.5 ACQUISITION / CONVERSION

5.5.1 TMU210 – COMPOUNDED POWER VALUES ACCURACY

Compounded value for Synchrocheck	Value
Compounded values accuracy	< 2 %*
Phase difference (computed Δφ value)	± 2° *

5.6 HOW TO MEASURE THE ISOLATION RESISTANCE

To measure the isolation resistance, execute the following steps:

1 Apply a continuous voltage of 500 V to both points.

2 Wait a minimum of 5 seconds to stabilize the reading.

3 Make a record of the isolation resistance.

4 The isolation resistance must be higher than 100 M ohms, in agreement with procedure LQD/P52/1

6 TYPE TESTS

The C26x unit has been designed, manufactured and certified fully compliant with the generally applicable environmental standards, such as:

- IEC 60255-27:2013
- IEC 61850-3:2013

6.1 DIELECTRIC STRENGTH TESTS

C26x Unit – Dielectric Strength Test

Type Test Name	Type Test Standard	Conditions
Insulation Resistance	IEC 61850-3:2013 subclause 6.9.2.2	> 500 MΩ at 500 V_{DC} (CM and DM)
Dielectric Voltage	IEC 61850-3:2013 subclause 6.9.2.3	50 Hz for 1 minute, 2 kV_{AC} (CM and DM), 0.5 kV (CM and DM)
High Voltage Impulse Test	IEC 61850-3:2013 subclause 6.6.3	5 kV

6.2 MECHANICAL TEST

Type Test Name	Type Test Standard	Conditions
Vibration Response	IEC 61850-3:2013 subclause 6.10.1	Class 2: Acceleration: 1g from 10 to 150 Hz
Vibration Endurance	IEC 61850-3:2013 subclause 6.10.1	Class 2: Acceleration: 1g from 10 to 150 Hz
Shock response	IEC 61850-3:2013 subclause 6.10.2	Class 1: 15g, 11 ms
Shock response	IEC 61850-3:2013 subclause 6.10.2	Class 2: 10g, 11 ms
Bump Test	IEC 61850-3:2013 subclause 6.10.2	Class 1: 10g, 16 ms
Single axis sine sweep seismic test	IEC 61850-3:2013 subclause 6.10.3	Class 2: Acceleration: 2g Displacement: 7.5 mm upon axis x Acceleration: 1g Displacement: 3.5 mm upon axis y

6.3 ATMOSPHERIC TEST

The product operating has been tested from -40°C to +65°C (certified from -25°C to +55°C).

Type Test Name	Type Test Standard	Conditions
Damp Heat – Steady state	IEC 61850-3:2013 subclause 6.9.3.6	Test Ab: +40°C / 56 days / 93% RH
Cold Test - Operating	IEC 61850-3:2013 subclause 6.9.3.2	Test Ad: - 25°C / 96 h -40°C / 96 h
Cold Test - Storage	IEC 61850-3:2013 subclause 6.9.3.4	Test Ab: -40°C / 96 h

Type Test Name	Type Test Standard	Conditions
Dry Heat Test – Operating	IEC 61850-3:2013 subclause 6.9.3.1	+55°C / 96 h +65°C / 96 h
Dry Heat Test – Storage	IEC 61850-3:2013 subclause 6.9.3.3	Test Bb: +70°C / 96 h +85°C / 96 h
Change of temperature	IEC 61850-3:2013 subclause 6.9.3.5	Test Nb Start +22°C Min -25°C, Max +55°C Min -40°C, Max +65°C
Damp heat cyclic (12h+12h)	IEC 61850-3:2013 subclause 6.9.3.7	Test Db Start +25°C RH=60% 96h (25°C, RH 97% and 55°C, RH 93%)

6.4 DC AUXILIARY SUPPLY TEST

Type Test Name	Type Test Standard	Conditions
Inrush current	IEC 61850-3:2013 subclauses 6.8.1.2 and 6.8.2.2	110 V_{DC}, I < 19.4 A, T < 110 ms 220 V_{DC}, I < 43.8 A, T < 92 ms
DC voltage interruptions and dips	IEC 61850-3:2013 subclause 6.7.3	ΔU 100% for 50ms ΔU 30% for 100ms, ΔU 60% for 100ms
Reverse polarity	IEC 60255-27:2013 subclause 10.6.6	Polarity – for the lower potential of the supply Polarity + for the lower potential of the supply
Voltage ripple	IEC 61850-3:2013 subclause 6.7.3	AC 100 Hz ripple superimposed on DC max. and min. auxiliary supply at 10% of rated DC value

6.5 AC AUXILIARY SUPPLY TEST

Type Test Name	Type Test Standard	Conditions
AC Voltage dips & short interruptions	IEC 61850-3:2013 subclause 6.7.3	ΔU 100% for 50ms ΔU 30% for 100ms ΔU 60% for 100ms

6.6 COMPATIBILITY (EMC) TESTS

Type Test Name	Type Test Standard	Conditions
Electrostatic discharge	IEC 61850-3:2013 subclause 6.7.3	Level 3: 6 kV contact / 8 kV air
Electrical Fast Transient	IEC 61850-3:2013 subclause 6.7.3	Level 4: 4 kV peak voltage (CDN) 2 kV peak voltage (Clamp) 5-kHz and 100-kHz repetition freq.
Surge immunity	IEC 61850-3:2013 subclause 6.73	Level 4: 4 kV (line-to-earth) – 2 kV (line-to-line)
Conduced disturbances, induced by radiofrequency fields	IEC 61850-3:2013 subclause 6.7.3	Level 3: 10 V, 0.15 – 80 MHz
Power Frequency Magnetic Field Immunity	IEC 61850-3:2013 subclause 6.7.3	Level 5: 100A/m continuous 1000A/m for 1 s

Type Test Name	Type Test Standard	Conditions
Pulse magnetic field	IEC 61000-4-9:2001	Level 5: 1000 A/m peak 6.4/16 µs magnetic field
Damped oscillatory magnetic field immunity	IEC 61000-4-10:2001 subclause 11	Level 5: 100 A/m peak Applied in all planes at: 100 kHz, repetition rate ≥ 40 Hz, during 60s 1 MHz, repetition rate ≥ 400 Hz, during 60 s
Power Frequency	IEC 61000-4-16 (1998)	CM 500 V / DM 250 V via 0.1 µF
Conducted emission	IEC 61850-3:2013 subclause 6.7.4	CISPR11 Gr 1 Class A and CISPR22 Class A: from 0.15 to 30 MHz
Radiated emission	IEC 61850-3:2013 subclause 6.7.4	CISPR22 Class A: from 30 to 1000 MHz
Radiated, radio-frequency electromagnetic fields	IEC 61850-3:2013 subclause 6.7.3	Level 3: 10 V/m Frequency sweep: 80-3000 MHz Spot frequencies: 80 MHz ± 0.5 % 160 MHz ± 0.5 % 380 MHz ± 0.5 % 450 MHz ± 0.5 % 900 ± 5 MHz 1 850 ± 5 MHz 2 150 ± 5 MHz
Mains Frequency Voltage	IEC 61850-3:2013 subclause 6.7.3	Level 4: 30 Vrms for 60 s 300 Vrms for 3 s
Slow damped oscillatory wave	IEC 61850-3:2013 subclause 6.7.3	Level 3: 2.5 kV (CM) and 1 kV (DM) 100 kHz and 1 MHz

7 ACHILLES CERTIFICATION

DS Agile C26x unit has been certified fully compliant with the requirements set forth by:

- **Achilles Level 1 Certification – Embedded devices**

  Achilles Level 1 certification examines a specified control protocol (Ethernet, ARP, LLDP, IP, ICMP, IGMP, TCP and UDP) to assess the safety, reliability and network robustness of industrial devices and certifies that they meet a comprehensive set of requirements and conformance criteria.

  DS Agile C26x unit was tested with the Achilles Test Platform's Level 1 test suite:

  - Date of Certification: **18th June 2018**
  - Firmware version: **cx66 – 2.0.0.0 – build59**
  - Certificate N°: **403-062818**

8 APPENDIX: PROTOCOLS AND PORTS USED BY THE C264

Application	Protocol / communication	Port
C264	SSH	22
	RPC standard service (UDP/TCP) IEC 61850 Agency CMT (UDP/TCP) MiCOM S1	111 102 5100, 5101 5001
	IEC 60870-5-104	2404

SECURE DEPLOYMENT GUIDE

C26X/EN SD/E71

Contents

1 INTRODUCTION

This document lists best practices to securely install and operate DS Agile C26x.

It applies to DS Agile 7.6 and later.

This document assumes that the reader is familiar with DS Agile C26x

2 SECURE INSTALLATION

2.1 ENVIRONMENT

DS Agile C26x is designed to be installed and operated in an industrial environment, connected to a private network.

While the rest of this guide describes security at the product level, requirements to achieve security go beyond just the product.

GE recommends that security applies to the whole system in which the DS Agile C26x is installed, following a defence-in-depth approach. Security includes (but is not restricted to):

- User security awareness training,
- Security policies,
- Network security measures, such as segmentation, use or firewalls, use of secure protocols…
- Security monitoring, such as network intrusion detection systems, security event logging…

Refer to Secure Deployment Guide user manual (SDG_enM_XXX) for more information on DS Agile automation and control system cyber security.

2.2 UPGRADING FIRMWARE TO THE LATEST VERSION

DS Agile C26x firmware must be upgraded to the latest version available for the major version used, to take advantage of all fixed known vulnerabilities.

The DS Agile C26x firmware upgrade procedure can be found in chapter INSTALLATION of C26x user manual (C26x_enM_XXX).

2.3 HARDENING

Hardening consists in disabling unused features in DS Agile C26x.

Most features won't be enabled unless explicitly configured.

The features listed below are enabled by default (mostly to simplify installation) and shall be reviewed:

- SSH command line interface. Refer to Installation chapter of C26x user manual (c26x_enM_XXX)
- SNMP (as of DS Agile 7.6, SNMP cannot be disabled)
- Ethernet ports (as of DS Agile 7.6, Ethernet ports cannot be disabled)

2.4 CONFIGURING SECURE PROTOCOLS

DS Agile C26x uses the TLS protocol in the following cases:

- Communication with the CMT configuration tool
- Security event logging to a syslog server over TLS
- EAP-TTLS with RADIUS

TLS needs a private key and public key certificate (PKC) to be deployed on the C26x, and a PKC to be deployed on the engineering workstation.

Refer to Installation chapter of C26x user manual (C26x_enM_XXX).

As DS Agile C26x does not support Certificate Revocation Lists nor certificate auto provisioning, GE recommends self-signed certificates with a long expiring date.

2.5 USER ACCESS CONTROL

2.5.1 DEFAULT USER ACCOUNTS

DS Agile C26x is delivered with one factory user account:

User name	Default password	Roles
Root	Root1234#	Observer System Engineer System Administrator Security Administrator

The Root username cannot be changed, cannot be deleted and cannot be disabled.

Password change is mandatory at first connection using the CMT.

Root user's password shall be changed at the end of commissioning (e.g. SAT) activity.

2.5.2 LOCAL USER ACCOUNT

DS Agile C26x supports the creation of personal user accounts.

When centralized authentication with RADIUS is not used, personal user accounts shall be created and granted the minimum number of roles needed to accomplish for his/her work.

When centralized authentication with RADIUS is used (see section Central Authentication with Radius Below), at least one user for each of the 4 supported roles shall be created, to be used when the RADIUS authentication server is unreachable.

The passwords for these shared accounts shall be kept secret until needed and changed after use.

Note: passwords are stored locally and protected by PBKDF2 with SHA-256 and a unique 64 bits salts.

Refer to Installation chapter of C26x user manual (C26x_enM_XXX).

2.5.3 ROLE BASE ACCESS CONTROL

DS Agile C26x supports 4 roles:

- Viewer
- Engineer
- System Administrator
- Security Administrator

For details of permissions associated with each role, refer to Functional Description chapter of C26x user manual (C26x_enM_XXX).

2.5.4 LOCAL SECURITY POLICIES

Local security policies shall be configured:

- Session's inactivity timeout (in minutes). Recommended value: 15
- Password minimum length. Recommended value: 9 or more
- Password complexity. Recommended value: enabled
- Maximum number of failed logins attempts before account locking. Recommended value: 5
- Duration of lockout (in seconds). Recommended value: 30
- Password expiration time (in months). Recommended value: none.
- Proper usage banner: can be customized using the SCE tool.

Refer to Installation chapter of C26x user manual (C26x_enM_XXX)

2.5.5 FRONT PANEL AUTHENTICATION BYPASS

Front panel authentication can be disabled to accommodate situations when the delay introduced by entering a password is not considered acceptable in operating conditions.

GE recommends that compensating measures be put in place, such as front panel access control with physical means.

Refer to Installation chapter of C26x user manual (C26x_enM_XXX).

2.5.6 CENTRAL AUTHENTICATION WITH RADIUS

When a central authentication server is available, DS Agile C26x shall be configured to authenticate users against it. This facilitate user management and account revocation, which is mandated by many standards and regulations.

The DS Agile C26x RADIUS supplicant supports 3 authentication protocols:

- PAP: insecure, available for backward compatibility reasons. Shall not be used.
- PEAPv0/EAP-MSCHAPv2
- EAP-TTLS

Authentication with RADIUS is configured using the SCE tool.

Refer to Installation chapter of C26x user manual (C26x_enM_XXX).

Refer to Secure Deployment Guide user manual (SDG_enM_XXX).

2.6 CONFIGURING SECURITY EVENT LOGGING

2.6.1 LOCAL SECURITY EVENT LOGS

DS Agile C26x firmware logs security events in a text file, that can be viewed using the CMT tool.

The log file cannot be modified. The file stores up to 2048 events and is circular: when full, the oldest event is deleted and the newest added.

Local security logging cannot be disabled and there is no need to configure it.

2.6.2 CENTRAL LOGGING

DS Agile C26x support logging security events to a central syslog server.

GE recommends forwarding all security logs to a central syslog server to provide a unique view of all system events as well as enforce log long term storage and integrity.

GE recommends configuring syslog over TLS when supported by the syslog server.

Logging to a syslog server is configured using the SCE tool.

Refer to Application chapter of C26x user manual (C26x_enM_XXXX).

2.7 NETWORK INTERFACE CONFIGURATION

2.7.1 DEDICATED ETHERNET PORT FOR CONFIGURATION

Ethernet port number 3 on the CPU board is dedicated to configuration.

While it is possible to do configuration and maintenance using any Ethernet port, GE recommends configuring the dedicated for such activity, leaving only operational protocols (such as IEC61850 and time synchronization) on the other ports.

Refer to Installation chapter, Boot parameters section of the C26x user manual (C26x_enM_XXX).

2.7.2 VLAN AND MAC ADDRESS FILTERING

In order to enforce network segregation and reduce the network attack surface, GE recommends that VLAN filtering and MAC address filtering to be configured on all Ethernet ports.

Particularly because IEC61850 extensively uses layer 2 broadcast, whitelisting multicast MAC addresses and VLANs (GOOSE, SV, PTP) on DS Agile C26x Ethernet interfaces will reduce the burden on the CPU board.

Refer to Installation chapter of C26x user manual (C26x_enM_XXX).

2.7.3 SRP28 BOARD

2.7.3.1 UPGRADING FIRMWARE TO THE LATEST VERSION

SRP28 firmware shall be upgraded to the latest version available, to take advantage of all fixed known vulnerabilities.

Refer to Installation chapter of C26x user manual (C26x_enM_XXX).

2.7.3.2 ACCESS CONTROL

SRP28 board is delivered with 2 factory user account:

User name	Default password	Roles
Root	changeit	Root
User	changeit	Root

The Root username cannot be changed, cannot be deleted and cannot be disabled.

Passwords shall be changed at installation and again at the end of commissioning (e.g. SAT) activity.

2.7.3.3 SECURITY POLICIES

SRP28 security policies shall be configured:

- Session’s inactivity timeout (in seconds). Recommended value: 600
- Password minimum length. Recommended value: 9 or more
- Password complexity. Recommended value: enabled
- Maximum number of failed logins attempts before account locking. Recommended value: 5
- Duration of lockout (in hours). Recommended value: 1
- Proper usage banner

Refer to Network Monitoring chapter of C26x user manual (C26x_enM_XXX).

3 MAINTAINING SECURITY

Once security has been properly configured, it is important to create procedures to maintain security over time.

3.1 PERIODIC SECURITY AUDITS

The configuration applied in Secure installation paragraph shall be recorded.

Periodically, particularly after maintenance activity, the security configuration shall be audited and deviations tracked and fixed.

3.2 BACKUP AND RESTORE PROCEDURES

Firmware installation packages and configuration files shall be backed up following any configuration/maintenance activity.

A restore procedure shall be prepared for quick service restoration following an incident.

3.3 VULNERABILITY MONITORING AND FIRMWARE UPDATES

GE responsibility discloses vulnerabilities found on its products.

User’s shall periodically check for newly published vulnerabilities and available firmware updates and define a security update policy.

All GE software packages are digitally signed. Digital signature shall be verified before installation.

4 DECOMMISSIONING

4.1 SECURE DECOMMISSIONING RECOMMENDATIONS

The goal of secure decommissioning is to prevent unauthorized disclosure of information.

Decommissioning is a complex matter: physical destruction may be forbidden by recycling/waste management laws, filesystem format is ineffective, advanced technical may be conducted offsite introducing supply chain and audit complications.

Hence GE cannot recommend a decommissioning method.

For organizations to have appropriate controls on the information they are responsible for safeguarding, they must first identify and classify information.

Regarding DS Agile C26x:

- Information is stored in soldiered flash memory and a removable SD card on the CPU board.
- Passwords are stored locally protected by PBKDF2 with SHA-256 and a unique 64 bits salts to make clear text recovery extremely difficult per today's standards.

Regarding the SRP28 board:

- Information is stored in soldiered flash memory on the board

Passwords are stored locally protected by DES-crypt()

5 APPENDICES

5.1 ACHILLES ACC LEVEL 1 CERTIFICATION

DS Agile C26x has obtained Achilles ACC Level 1 certification.

Particularly, the certification acknowledge that DS Agile C26x operation go back to normal when the communication stress test stops.

5.2 LIST OF SUPPORTED PROTOCOLS

DS Agile C26x supports the following protocols (as server):

Protocol	Port	Comment
SSH	22	(Secure) C26x Shell
IEC 61850 Agency	102	This port is used for the IEC61850 communication (server side)
IEC61850 component for the "tunneling"	100x	Used for Tunneling feature provided by 61850 agency
RPC standard service (UDP/TCP)	111	Used for Tunneling feature provided by 61850 agency. Used by the IEC61850 component to directly call procedures between client and server.
CMT over TLS	5100	(Secure)
CMT IP search (UDP)	5101	(Secure) Device search cx66 with IP@ : UDP - port 5101
MiCOM S1 over TLS	5001	(Secure)
IEC 60870-5-104	2404	
Radius (UDP)	1812 1813	(Secure)for authentication (Secure)for accounting
SNTP (UDP)	123	
SNMP (UDP)	161	
PTP (UDP)	319	
PTP (UDP)	320	
Isagraf (TCP)	1131	
Isagraf (TCP)	1113	
Syslog (TCP over TLS)	6514	(Secure)
Syslog (UDP)	514	(Secure)

5.3 DETERMINISTIC OUTPUT

In the event of an anomaly, DS Agile C26x triggers the physical watchdog relay.

Additionally, depending on the type of anomaly, DS Agile C26x will enter:

- Downgraded mode: affected data will be marked “invalid”
- Fault mode: a restarting loop during which no data is available
- Halt mode: all output relays are de-energized, no data is available, operation is stopped.

5.4 RESOURCE MANAGEMENT

By using the following features, DS Agile C26x makes sure that security function does not interfere with operations:

- Circular local log file (protect against filesystem over usage)
- Dedicated Ethernet management interface
- Capability to disable front panel authentication
- Redundancy support, to upgrade one IED’s firmware while the backup IED is in charge of operations.

GLOSSARY

C26X/EN LX/E71a

Term/Acronym	Description
100Base Fx	Fiber optic ports are full/half duplex at 100 Mbps only.
10Base Tx and 100Base TX	The copper ports are full/half duplex and auto-sense the transmission speed. They will auto-negotiate with the connected device to determinate the optimal speed. When the connected device is only capable of transmitting at 10 Mbps, the Ethernet switch unit or board follows 10 Mbps.
A/D	Analog/Digital
ACSI	Abstract Communication Service Interface Mapping from standard IEC 61850 abstract specification of a communication service to a concrete communication infrastructure based on the CORBA standard.
ADC	Analog to Digital Converter
AE qualifier	Application Entity qualifier (Used internally by IEC 61850 to identify a server Application)
AI	Analogue Input (Measurement Value including state attribute) Usually voltage or current DC signals delivered by transducers, and representing an external value (refer to CT/VT for AC).
AIU	Analogue Input Unit C264 controller's board for DC analogue inputs
Alarm	An alarm is any event set as alarmed during the configuration process
AO	Analogue Output Value corresponding to a desired output current applied to a DAC
AOU	Analogue Output Unit (C264 controller's board for analogue outputs)
ASCII	American Standard Code for Information Interchange
ASDU	Application Specific Data Unit Name given in the OSI protocol for applicative data (T101, T104)
AVR	Automatic Voltage Regulation built-in automation used to regulate secondary voltage using an automatic tap change control. A set of features can be added, refer to C264/EN FT
Bay	Set of LV, MV or HV apparatus (switching devices and transformers) and IEDs (Protection, Measurement…) usually built around a Circuit Breaker and controlled by a Bay Controller Unit.
BCD	Binary Coded Decimal C264-supported coding on a set of Digital Inputs that determines a Digital Measurement, then a Measurement value (with a specific invalid code when coding is not valid). Each decimal digit is coded over 4 binary digits.
BCP	Bay Control Point Name given to the device or part used to control a bay. It can be a Mosaic Panel, a C264 unit's LCD,… Usually associated with Remote/Local control.
BCU	Bay Control Unit Name given to the C264 that manages a bay.
BI	Binary Input (or Information) Name given in the C264 controller to information that has already been filtered, before it becomes an SPS, DPS… with time tag and quality attributes.
BIU	Basic Interface Unit C264 controller's board for auxiliary power supply, watchdog relay, redundancy I/O.
BRCB	Buffered Report Control Block
CB	Circuit Breaker Specific dipole switch with capability to make line current and break fault current. Some have isolation capability (nominal earth on each side)
CCU	Circuit breaker Control Unit C264 controller's board dedicated to switch control with 8 DIs, and 4 DOs
CDM	Conceptual Data Modeling Modeling of system/device data using a hierarchy of structured data (called object of class) with their attributes, method or properties and the relations between them. It maps common data to devices or components of devices, with a guaranty of interoperability.

Term/Acronym	Description
Class	Defined in IEC 61850 as the description of a set of objects that share the same attributes, services, relationships, and semantics.
Client	Defined in IEC 61850 as an entity that requests a service from a server and that receives unsolicited messages from a server.
CMT	Controller Management Tool
CO	Command, logic information Output (Functional Component) / Contact Open
COMTRADE	COMmon format for TRAnsient Data Exchange (IEC 60255-24 international standard)
CPU4	Central Processing Unit C264 controller's main board
CT	Current Transformer Basically the device connected to the electrical process used to extract a current measurement. By extension part of a device (C264) that receives AC values and converts it to a numerical measurement value.
CT/VT conventional	Current and Voltage transformers By extension, it is the C264 controller's TMU board.
DAC	Data Acquisition component of the GPT
DAC	Digital to Analogue Converter Used to generate analogue signals (usually DC) from a digital value.
DANP	Double Attached Node implementing PRP (defined by IEC 62439-3) Such an IED sends the messages over two separate networks.
DB	DataBase Tool or set of data that define all the configuration of a system or specific device such as a substation computer or bay controller. Contrary to setting parameters, a DB has a structure that cannot be modified on-line. DBs are always versioned.
DCF77	External master clock and protocol transmission LF transmitter located at Mainflingen, Germany, about 25 km south-east of Frankfurt , broadcasting legal time on a 77.5 kHz standard frequency.
DCO	Double Control Output
DCS	Digital Control System Generic name of system based on numeric communication and devices, to be opposed to traditional electrically wired control.
DCT	Double CounTer Counter based on 2 DIs with complementary states (counting switchgear operations for example).
DE	Direct Execute
DFT	Discrete Fourier Transform
DI	Digital Input Binary information related to the presence or to the absence of an external signal, delivered by a voltage source.
DIU	DC Input Unit C264 controller's board hosting digital inputs
DM	Digital Measurement Measurement value acquired from DIs with a specific encoding: BCD, Gray, 1 among N…
DO	Digital Output Used to apply a voltage to an external device via a relay, in order to execute single or dual, transient or permanent commands.
DOF	Degree Of Freedom Used for a template attribute, that can be modified or not when used. An attribute has a degree of freedom if a user can modify the values of its instances.
DOU	Digital Output Unit C264 controller's board hosting digital outputs.
DP	Data Point, low-level object in the structure, wired or not, with or without links

Term/Acronym	Description
DPC	Double (Point) Control Two digit and/or relays outputs with complementary states (OPEN, CLOSE) used for device control.
DPS	Double Point Status, information derived from 2 digital inputs Usually used for Position indication of switching devices (OPEN, CLOSE).
EPATR	"Ensemble de Protection Ampèremétrique de Terre Résistante" (French legacy very resistive earth current module).
EQL	Equation Logic, especially for interlocking.
Event	An event is a time-stamped change of state/value acquired or transmitted by a digital control system.
FAT	Factory Acceptance Test Validation procedures executed with the customer at the factory.(i.e. SAT)
FBD	Functional Block Diagram One of the IEC 61131-3 programming languages (language used to define configurable automations).
FIFO	First In First Out
FP	Front Panel
FSS	Force Suppress Substitute
FTP	Foil Twisted Pair
Gateway	Level 6 session of OSI, the gateway can be any device transferring data between different networks and/or protocols. The RTU function of the C264 behaves like a gateway at the SCADA or RCP level. The DS Agile Gateway is a separate PC-based application dedicated to this function.
GHU	Graphic Human interface Unit C264 controller's front panel interface (LCD, buttons, front RS port)
GIS	Gas Insulated Substation
GMT	Greenwich Mean Time, former absolute time reference. Replaced by UTC.
GOOSE	Generic Object Oriented Substation Event
GPS	Global Positioning System Based on triangulation from satellite signal, that transmit also absolute GMT time used to synchronise a master clock.
GPT	Generic Protocol Translator software, supplied by ASE
Group	Logical combination of BIs (i.e. SP, DP, SI or other groups)
Half-duplex	A system that allows packets to transmitted and received, but not at the same time. Contrasts with full-duplex.
HBU	High Break Unit: BCU board used in applications requiring high rupture capacity.
HMGA	Horizontal Measurement Graphical Area
HMI	Human Machine Interface Can be DS Agile aView (system HMI) or C264 LCD (Local HMI) or LEDs, Mosaic...
HSBP	High Speed BackPlane (internal Ethernet link between a CPU4 and a SRP28x boards through the HSBP bus)
HSR	High availability Seamless Redundancy protocol. HSR is typically used in a ring topology, however redundant connections to other networks are possible, in particular to PRP networks.
HV	High Voltage (for example 30 kV to 150 kV)
I/O	Input/Output
IEC	International Electro-technical Commission
IED	Intelligent Electronic Device Global term covering a whole range of microprocessor-based products capable of data collection and information processing.
IRIG-B	Inter-Range Instrumentation Group standard format B. This is an international standard for time-synchronisation based on an analogue signal.

Term/Acronym	Description
JAMMED	Invalid state of a Double Point: Occurs when the 2 associated digital inputs are still in state 0 after a user- settable time-delay, i.e. when the transient state “motion” is considered as ended.
L/R	Local / Remote
L-BUS	Legacy Bus Generic name of Legacy or field networks and protocols used to communicate between C264 (Legacy Gateway function) and IED on field bus. Networks are based on (RS232,) 422, 485. Protocols are IEC 60850-5-103 (T103 is not supported in this version or VDEW), Modbus.
LC	Fibre optic snap-on connector, IEC 61754-20-compliant, for high density connection.
LCD	Liquid Crystal Display on the C264 front panel HMI
LD	Ladder Diagram, one of the IEC 1131-3 programming languages (language used to define configurable automations).
LD	Logical Device, defined in IEC 61850 as: An entity that represents a set of typical substation functions.
LDBI	Database identity brick
LHMI	Front panel Local HMI of the C264 controller
LN	Logical Node Defined in IEC 61850 as an entity that represents a typical substation function.
LOC	Local Operator Console, dedicated to maintenance operations
LPHD	Logical node PHysical Device
LSB	Least Significant Bit
LSP	Load Shedding Pre-selection
LV	Low Voltage
MAC address	The Media Access Control address is a unique 48-bit hardware address assigned to every network interface card. Usually written in the form 01:23:45:67:89:ab
MCB	Miniature Circuit Breaker. In the SCE configuration, its position is associated with the tap changer.
MEAS	Values acquired through digital or analogue inputs (with value, state, and time stamp)
Metering (non-tariff)	Values computed depending on the values of digital or analogue inputs during variable periods of time (time integration).
Metering (tariff)	Values computed depending on the values of digital or analogue inputs during variable periods and dedicated to energy tariff metering. These values are provided by dedicated “tariff computers” which are external to the control system.
MIDOS connector	Alstom 28-pin terminal block used for CT/VT acquisition
MMS	Manufacturing Message Specification (ISO 9506)
Modbus	Communication protocol used on secondary networks with IEDs or with a SCADA RCP. There are 2 versions: standard MODICON and Alstom.
Module	Term used in DS Agile SCE to encompass all electrical HV devices: switchgear, transformers, motors, generators, capacitors, …
MOTION	Transient state of a Double Point Occurs when the two associated digital inputs are momentarily in state 0 (e.g. position indication when a switching device is operating). The acceptable duration of the transient state is user-settable.
MU	Merging Unit Interface device which takes signals from the instrument transformer sensors and performs digital signal processing to generate and distribute output sampled value streams according to IEC 61850-9-2LE standardised definitions for communication with substation IEDs and controllers.
MV	Medium Voltage or Measurement Value
NC	Normally Closed (for a relay/contact)

Term/Acronym	Description
NCIT	Non-Conventional Instrument Transformers New generation of captor-based, for example using light diffraction under an electric field, CT/VTs, without spires, that provide direct voltage and current numerical values to the communicating IEDs.
NO	Normally Open (for a relay/contact)
OSI	Open System Interconnection ISO standard that splits and defines communication in 7 layers : physical, link, network, transport, session, presentation, application.
OWS	Operator WorkStation (DS Agile aView)
PHY	OSI Physical Layer: The physical layer provides for transmission of cells over a physical medium.
PLC	Programmable Logic Control: Includes PSL and ISaGRAF Within the PLC-programs are defined the configurable control sequences or automations used by DS Agile IEDs and Gateway (ISaGRAF only).
PRP	Parallel Redundancy Protocol (defined in IEC 62439-3:2010)
PSL	Programmable Scheme Logic
PTP	Precision Time Protocol: Protocol used to synchronize clocks throughout a computer network. Defined in the standard IEEE 1588.
RCC	Remote Control Centre: computer or system that is not part of the substation control system. RCC communicates with and supervises the DS Agile system using a protocol.
RCP	Remote Control Point Name given to the device or part used to remotely control several bays or substations. Usually associated with Remote/Local substation control. It is a SCADA interface managed through the Telecontrol BUS. Several RCPs can be managed with different protocols.
RedBox	PRP or HSR Redundancy Box
RI	Read Inhibit, output that indicates the availability of an analogue output (e.g. during DAC processing time).
RMON	Short for remote monitoring, a network management protocol that allows network information to be gathered at a single workstation. Whereas SNMP gathers network data from a single type of Management Information Base (MIB), RMON 1 defines nine additional MIBs that provide a much richer set of data about network usage. For RMON to work, network devices, such as hubs and switches, must be designed to support it. The newest version of RMON, RMON 2, provides data about traffic at the network layer in addition to the physical layer. This allows administrators to analyze traffic by protocol.
RMS	Root Mean Square Average value of a sinusoid that is used for calculations.
RTU	Remote Terminal Unit Standalone controller that acquires data and transmits it to RCP or SCADA. The RTU is attached to the T-BUS.
SAN	Single Attached Node (defined by IEC 62439-3). Unlike DANP, such an IED requires a REDundancy Box to send the messages over two separate networks or over an HSR network.
SAT	Site Acceptance Test Validation procedures performed on site with the customer.
SBMC	Site-Based Maintenance Control mode A bay in SBMC mode does not take into account the commands issued from the RCP; moreover, some of its digital points and measurements (defined during the configuration process) are no longer sent to the RCP (they are “automatically” suppressed).
SBO	Select Before Operate Control made of two steps, selection and execution. The selection step returns a feedback. It can be used to select a circuit before execution of the command. Commands are included in a protocol frame between the system HMI and the BCU and sent over wired outputs to the switching device (e.g. DO select with DI Select, then DO execute).
S-BUS	Station Bus, federal network between DS Agile devices.
SCADA	Supervisory Control And Data Acquisition, equivalent to RCC.

Term/Acronym	Description
SCE	System Configuration Editor
SCL	System Configuration Language (IEC 61850-6) for substation automation
SCP	Substation Control Point Name given to the device or part used to control locally several bays or substations. Usually associated with Remote/Local substation control. It normally refers to DS Agile's system HMI, aView.
SCS	Substation Control System
SCT	Single Counter
SCU	Switchgear Control Unit used in Process Bus applications.
Server	Defined in IEC 61850 as an entity that provides services to clients or issues unsolicited messages.
Setpoints (analogue)	Analogue setpoints are analogue outputs delivered as current loops. Used to send instruction values to the process or auxiliary device.
Setpoints (digital)	Digital values sent on multiple parallel wired outputs. Each wired output represent one bit of the value. Digital setpoints are used to send instruction values to the electrical process or to auxiliary devices.
SFC	Sequential Function Chart IEC 61131-3 programming language (used to define configurable automation)
SFP	Small Form-factor Pluggable transceiver Hot-pluggable transceiver used for both telecommunication and data communications applications.
SI	Single Input or System Indication: Binary information that does not come from an external interface, but is related to an internal state of the controller (time status, hardware faults…) or the result of an inner function (AR, …) PSL or ISaGRAF.
SIG	Status Input Group (idem MPS)
SINAD	Signal-plus-Noise-plus-Distorsion to Noise-plus-Distorsion ratio, in dB
SIT	Status Input Double Bit (idem DPS)
SNMP	Simple Network Management Protocol: protocol governing network management and monitoring of network devices and their functions.
SNTP	Simple Network Time Protocol
SOE	Sequence Of Events, i.e. the event list
SP SPS SPC	Single Point Single Point Status Single Point Control
SPI	Step Point Indication (same as TPI)
SRP	Switch Redundancy Protocol, PRP Ethernet switch board fitted in H38x Ethernet switch and in C264 BCU.
ST	Structured Text An IEC 61131-3 programming language to define configurable automation.
STP	Shielded Twisted Pair.
Suppression (Automatic)	A binary information belonging to a bay in SBMC mode is automatically suppressed for the remote controller. However changes of state are indicated locally, at SCP level.
Suppression (Manual)	A binary information can be suppressed by a command issued by an operator. No subsequent change of state on a "suppressed information" can trigger any action such as display, alarm or transmission.
T-BUS	Telecontrol Bus, generic name of networks and protocols used for communications between DS Agile Gateway or the C264 Telecontrol Interface function and the RCP. Networks use RS232, RS485, or Ethernet (T104). Protocols are IEC 60850-5-101 (T101) or MODICON Modbus.

Term/Acronym	Description
TC	True Contact A double counter is acquired on two contacts. One is called the true contact (TC), the other is the complemented contact (CC). Normally these contacts have complementary states.
TCIP	Tap Changer In Progress
TDD	Total Demand Distortion, similar to the THD but applied to currents and with a rated current (In) used as reference.
THD	Total Harmonic Distortion, sum of all voltage harmonics.
TMU	Transducerless Measurement Unit
TPI	Tap Position Indication (for transformers). Frequently acquired via a Digital Measurement.
TS	Tele-Signalling Logic position transmitted by a remote signal
UCA	Utility Communications Architecture Communications standard mainly used in the US
URCB	Unbuffered Report Control Block
UTC	Universal Time Co-ordinates (or Universal Time Code) UTC replaces GMT and it is identical.
VdBS	Versioned data Base System, SCE-generated databag ready for download.
VDEW	German subset of the IEC 60870-5-103 protocol.
VMGA	Vertical Measurement Graphical Area
Voltage level	Set of bays in which plants and devices operate at the same voltage (e.g. 275 kV).
VT	Voltage Transformer Basically the device connected to the electrical process used to extract a voltage measurement. By extension part of a device (C264) that receives this AC value & converts it to a numerical measurement value. VTs are wired in parallel.

WARNING

This guide gives instructions for installation, commissioning and operation of the **DS Agile C26x**.
However, the guide cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Please contact the appropriate GE Grid Solutions technical sales office and request the necessary information.

Refer to the System Release Notes for new features.

Any agreements, commitments, and legal relationships and any obligations on the part of GE Grid Solutions, including settlement of warranties, result solely from the applicable purchase contract, which is not affected by the contents of the guide.

PC OPERATING SYSTEM COMPATIBILITY

GE Grid Solutions has conducted compatibility and performance tests with the version of Microsoft's Windows operating system indicated at the beginning of the Introduction chapter of this manual.

Depending on when the system is installed or upgraded, some of the hardware components described in this manual may be no longer available. Please check currently approved hardware in the latest release.

Although the software may run with other versions of Windows, GE Grid Solutions does not take any responsibility in possible malfunctions and may not be able to provide support for problems occurring when running our software on an unapproved operating system.

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