

LONWORKS Power Line Communication Adapter CAL 06000/CCL 06000

User's Manual

Rev A

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1 GENERAL

This manual contains information about the ABB LonWorks Power Line Communication (PLC) adapter, which is an adapter of the serial communication adapters (SCA) family for electronic electricity meters manufactured by ABB Automation Technologies AB. Throughout this manual the ABB LonWorks Power Line Communication (PLC) adapter will be referred to as the SCA or the adapter. The purpose of this manual is to give the user a good overview and understanding of the features the ABB LonWorks PLC adapter offers.

WARNING! The voltages connected to the SCA are dangerous and can be lethal. Therefore it must be insured that the terminals are not touched during operation. When installing the SCA all voltages must be switched off.

Note: The adapter is equipped with a fuse for overload protection.

2 PRODUCT DESCRIPTION

The ABB LonWorks PLC adapter is an ABB serial communication adapter product that enables automatic meter reading (AMR) of ABB electricity meter over a power line network using the LonTalk protocol. Like all other ABB serial communication adapters the ABB LonWorks PLC adapter have the size of two DIN-modules and follows the ABB's pro M-standard, which defines mechanical dimensions, way of mounting (35 mm DIN-rail) and design outlook. Furthermore the adapter follows and meets the safety requirements of DIN EN 50090-2-2.

The ABB LonWorks PLC communication adapter is available both for the proprietary A-band for electrical utilities and the public C-band. The adapter conforms to the LonMark profile of Utility Data Logger.

2.1 PRODUCT OVERVIEW

The different parts of the communication adapter are depicted below.

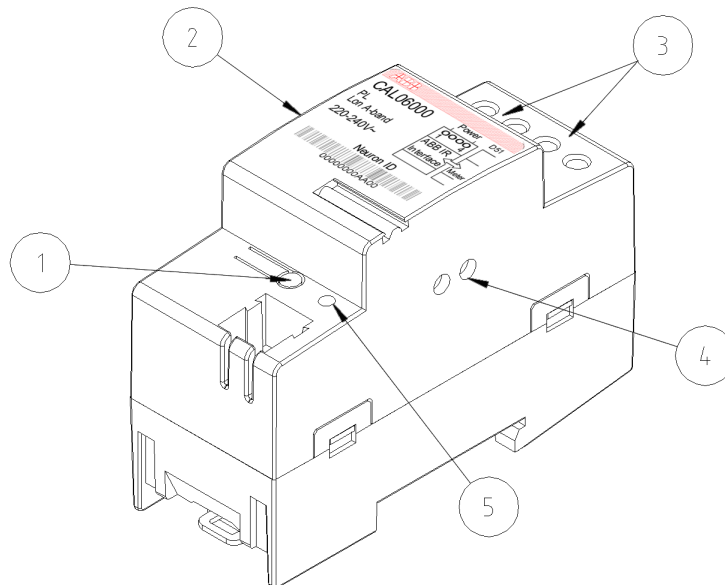


Figure 1: SCA parts.

1. Service pin.
2. Label with type designation and Neuron ID.
3. Terminal for connecting power.
4. Infra-red communication port.
5. Service LED.

2.2 TYPE DESIGNATION

Below are tables with explanation for all positions in the type designation for the SCA.

Type	Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Pos 6-8
Basic						
Serial Communication Adapters	C					
Media						
Power Line, Band A		A				
Power Line, Band C		C				
Ethernet		E				
GSM/GPRS		G				
RS 232		R				
Twisted Pair		T				
Protocol						
LonWorks			L			
M-Bus			M			
				0		
Supply voltage						
Powered by device					4	
100 - 240 V					5	
220 - 240 V					6	
Optional functionality						
No options						000

Table 1: Type designation of ABB Serial Communication Adapters.

3 INSTALLATION

1. Disconnect the power supply.
2. Strip the wires and connect them to the top terminals of the SCA.
3. Place the SCA to the left of the meter and snap it on the DIN-rail.
4. Verify that the SCA is correctly wired and the voltage is according to the technical specification before the power is turned on.

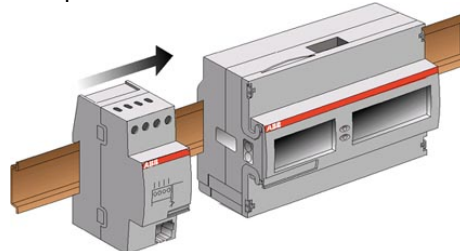


Figure 2: Installation of the SCA.

3.1 COMMISSIONING/OPERATION

Before the communication adapter is commissioned the Service LED is flashing, after commissioning it is off.

3.2 SERVICE LED

The Service LED (2) in figure 1. indicates the state of the communication adapter. The chart below describes the state of the communication adapter and how the Service LED indicates this.

Service LED	Communication Adapter Status
Green	Service pin pushed in.
Flashing Green	Communication adapter not commissioned.
Flashing Red	Wink

4 TECHNICAL DATA

Network Protocol and Standards Compatibility

Data protocols:	LonWorks profile Utility Data Logger.	
Communication standard:	EN 50 065-1	
Frequency:	A-band	86 kHz
	C-band	132 kHz

Power Supply

Nominal voltage:	220-240 V AC	
Voltage Range:	- 20% to +15% of nominal voltage.	
Frequency:	50/60 Hz \pm 5%	
Power consumption:	2.5 VA at 230 V AC, 50 Hz.	
Terminal wire area:	0 – 2.5 mm ²	
Recommended tightening torque:	0.5 Nm	

Environmental Specifications

Operating temperature range:	-40 °C to +25 °C
Storage temperature range:	-40 °C to +70 °C
Humidity:	75% yearly average 95% on 30 days/year

Standards

Safety:	DIN EN 50090-2-2.
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Mechanical Data

Casing material:	Polyamide
Protection class:	IP 20
Weight:	189 g

4.1 DIMENSIONS

The physical dimensions of the SCA are displayed below.

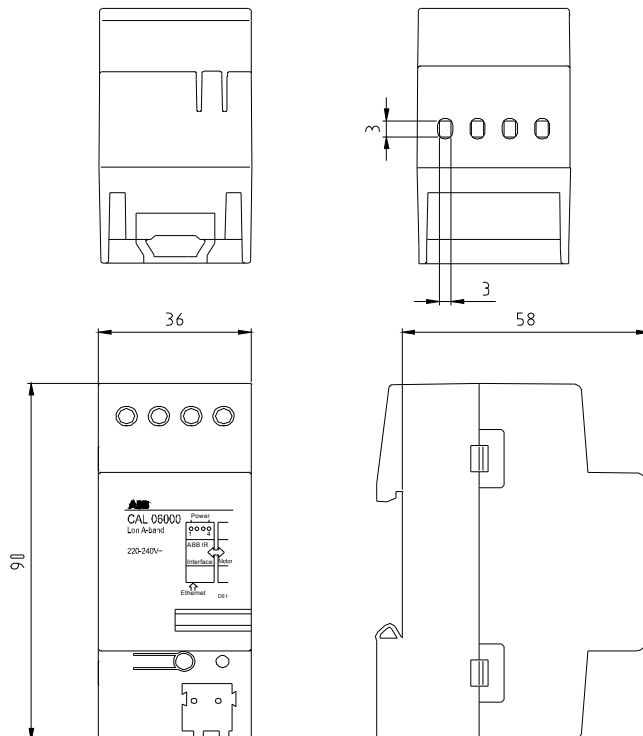


Figure 3: The physical dimensions of the SCA.

5 LONWORKS

LonWorks is a communication system for home and building automation. It is a decentralized system with distributed intelligence. LonWorks supports communication on various media.

The adapter consists of a power line transceiver and a 3120 Neuron processor for communication over the power line as a media according to EN 50 065-1. Depending on model the communication adapter uses the A-band (86 kHz) or the C-band (132 kHz) for communication.

NOTE: Like all products that communicate over the power line, the adapter may be affected by the prevailing network condition, like harmonics and the loads that are attached.

5.1 COMMUNICATION OBJECTS

The communication objects can be divided into two groups, node objects and register objects of the profile Utility Data Logger. Normally all values of the objects are updated every 10 seconds, however faster updates of status and alarm objects can be achieved by sending an nviRequest of RQ_UPDATE_STATUS or RQ_UPDATE_ALARM respectively to the adapter.

Node Object

Register	Network variable name	SNVT Type	Description
	nviRequest	SNVT_obj_request	Supports RQ_NORMAL, RQ_UPDATE_STATUS, RQ_REPORT_MASK, RQ_CLEAR_STATUS, RQ_UPDATE_ALARM and RQ_CLEAR_ALARM.
	nvoStatus	SNVT_obj_status	Status of object.
	nvoAlarm	SNVT_alarm	Alarm output of object.

Utility Data Logger registers

Register	Network variable name	SNVT Type	Valid Range	Description
Time	nvoTime	SNVT_time_stamp	year: 0,...,3000 (AD) month: 0,...,12 day: 0,...,31 hour: 0,...,23 minute: 0,...,59 second: 0,...,59	Reading of real time.
	nviTimeSet	SNVT_time_stamp	year: 0,...,3000 (AD) month: 0,...,12 day: 0,...,31 hour: 0,...,23 minute: 0,...,59 second: 0,...,59	Set real time (Normal). Note: nviTimeSet can only set time when the time difference is less than 300 seconds between the newly set time and the current time stored in the electricity meter.
	nviMasterTime	SNVT_time_stamp	year: 0,...,3000 (AD) month: 0,...,12 day: 0,...,31 hour: 0,...,23 minute: 0,...,59 second: 0,...,59	Setting of real time (Master).
	nvoPwCutCount	SNVT_count	0,...,65 535	Cumulative power cut counter. Resolution (1 count)

	nvoPwCutLength	SNVT_elapsed_tm	day: 0,...,65 534 hour: 0,...,23 minute: 0,...,59 second: 0,...,59 millisecond: 0,...,999	Cumulative power cut length.
	nvoRelay1	SNVT_switch	value: 0,...,100 % state: 0 off 1 on 0xFF undefined	Not in use.
	nvoRelay2	SNVT_switch	value: 0,...,100 % state: 0 off 1 on 0xFF undefined	Not in use.
	nvoS01	SNVT_switch	value: 0,...,100 % state: 0 off 1 on 0xFF undefined	State of S01 input.
	nvoS02	SNVT_switch	value: 0,...,100 % state: 0 off 1 on 0xFF undefined	State of S02 input.
	nvoRegVal1	SNVT_reg_val_ts	See 5.1.1. below.	Current value of register object.
	nviHistTime1	SNVT_time_stamp	year: 0,...,3000 (AD) month: 0,...,12 day: 0,...,31 hour: 0,...,23 minute: 0,...,59 second: 0,...,59	History value select, for request of Load Profile data.
	nvoHistVal	SNVT_reg_val_ts	See section 5.1.1. below.	History value of register object, for readout of Load Profile data.
	nciBaseValue1	SNVT_reg_val	raw: -2147483648 to 2147483647 unit: reg_val_unit_t enumeration type nr_decimals: 0,...,7	Not in use.
	nvoRegValS01	SNVT_reg_val_ts	See section 5.1.1. below.	Current value of register object.
	nviHistTimeS01	SNVT_time_stamp	year: 0,...,3000 (AD) month: 0,...,12 day: 0,...,31 hour: 0,...,23 minute: 0,...,59 second: 0,...,59	History value select, for request of Load Profile data.
	nvoHistValS01	SNVT_reg_val_ts	See section 5.1.1. below.	History value of register object, for readout of Load Profile data.
	nciBaseValueS01	SNVT_reg_val	raw: -2147483648 to 2147483647 unit: reg_val_unit_t enumeration type nr_decimals: 0,...,7	Not in use.
	nvoRegValS02	SNVT_reg_val_ts	See section 5.1.1. below.	Current value of register object.

	nviHistTimeS02	SNVT_time_stamp	year: 0,...,3000 (AD) month: 0,...,12 day: 0,...,31 hour: 0,...,23 minute: 0,...,59 second: 0,...,59	History value select, for request of Load Profile data.
	nvoHistValS02	SNVT_reg_val_ts	See section 5.1.1. below.	History value of register object, for readout of Load Profile data.
	nciBaseValueS02	SNVT_reg_val	raw: -2147483648 to 2147483647 unit: reg_val_unit_t enumeration type nr_decimals: 0,...,7	Not in use.
	nviOutputState	SNVT_switch	Value: 0,5 - Output 1 1,0 - Output 2 1,5 - Output 3 2,0 - Output 4 State: 0 - turn OFF 1 - turn ON	To control the output/s and there state.
	nvoMeterID	SNVT_str_asc	ascii[31], each 0..255	Serial number of the Electricity Meter.

5.1.1 SNVT_REG_VAL_TS

The below table describes the SNVT type of SNVT_reg_val_ts of the ABB LonWorks PLC adapter.

Field	Valid Range	Comments
raw	-2147483648 to 2147483647	
unit	Enumeration type RVU_unit	Where <i>unit</i> is the unit of the quantity.
nr_decimals	0,...,7	Number of decimals.
Status	0,...,15	<p>0x01 Time has been changed during the measuring period and the change exceeds the error limit, or time is invalid time.</p> <p>0x02 Internal/External error during the measuring period; for example:</p> <ul style="list-style-type: none"> - watchdog reset. - error in EEPROM operation. - memory checksum error. - polling error from the external device. - register overflow or underflow (with subtracting pulse inputs) during the measuring period. <p>0x03 Power failure during the measuring period.</p> <p>0x04 Illegal value request:</p> <ul style="list-style-type: none"> - uninitiated after boot up. - nviHistChoice or nviHistTime out of range (input values out of range).
reg_state	0,1	<p>Register State:</p> <p>0 = Register is deactivated. Object does not measure into the register.</p> <p>1 = Register is activated. Object measures into the register.</p>

5.1.2 STATUS OF OBJECTS

The table below describes the network variable nvoStatus flags of the ABB LonWorks PLC adapter. Please note that the error/s in nvoStatus will automatically be cleared when the error is taken care of, however clearing of errors in nvoStatus can also be done manually by sending an nviRequest of RQ_CLEAR_STATUS to the adapter.

Field	Valid Range	Comments
Object ID	0,...,8	ID of object with in node, always 0 in ABB LonWorks PLC adapter.
Invalid ID	0, 1	1 means requested ID is not implemented <input type="checkbox"/> in this node.
Invalid request	0, 1	1 means request for unimplemented function.
Disabled	0, 1	1 means object disabled.
Out of limits	0, 1	1 means object exceeded alarm limits.
Open circuit	0, 1	1 means phase error detected.
Out of service	0, 1	1 means watchdog bitten, power cut length > 2 days, CRC fault.
Mechanical fault	0, 1	Not in use.
Feedback failure	0, 1	Not in use.
Over range	0, 1	1 means the value of register object is over range.
Under range	0, 1	Not in use.
Electrical fault	0, 1	1 means EEPROM fault, RTC read/write fault.
Unable to measure	0, 1	Not in use.
Communication failure	0, 1	Communication failure
Fail self test	0, 1	Not in use.
Self test in progress	0, 1	Not in use.
Locked out	0, 1	Not in use.
Manual control	0, 1	Not in use.
In alarm	0, 1	1 means object is in alarm.
In override	0, 1	Not in use.
Report mask	0, 1	1 means status is an event mask.
Programming mode	0, 1	Not in use.
Programming fail	0, 1	Not in use.
Unsigned alarm notify	0, 1	Not in use.
Reset complete	0, 1	Not in use.

5.1.3 ALARM OF OBJECTS

The table below describes the network variable nvoAlarm flags of the ABB LonWorks PLC adapter. Please note that alarms which has been set in the fields of Value [0] and Value[1] will not be automatically cleared even though the error/s has been taken care of, in order to clear these an nviRquest of RQ_CLEAR_ALARM has to be sent to the adapter.

Field	Valid Range	Comments
Location	6 Bytes	Location of node – zone number, description of characters used for location of the device.
Object ID	2 Bytes	ID of object with in node, always 0 in ABB LonWorks PLC adapter.
Alarm type	1	In alarm case always 1.
Priority level	0,...,3	Priority level of alarm.
Index to SNVT	2 Bytes	Index of NV on the device.
Value [0], bit 0	0, 1	EEPROM fault
Value [0], bit 1	0	DELTAsingle: RTC Error.
Value [0], bit 2	0	Not in use.
Value [0], bit 3	0	Not in use.
Value [0], bit 4	0, 1	EEPROM CRC fault
Value [0], bit 5	0	Not in use.
Value [0], bit 6	0	DELTAsingle: External data input signal out of specification.
Value [0], bit 7	0	Not in use.
Value [1], bit 0	0, 1	Communication error.
Value [1], bit 1	0, 1	Meter changed.
Value [1], bit 2	0	Not in use.
Value [1], bit 3	0	Not in use.
Value [1], bit 4	0	Not in use.
Value [1], bit 5	0	Not in use.
Value [1], bit 6	0	Not in use.
Value [1], bit 7	0	Not in use.
Value [2], bit 0	0	Not in use.
Value [2], bit 1	0, 1	Phase error.
Value [2], bit 2	0, 1	Overvoltage 10%.
Value [2], bit 3	0, 1	Undervoltage 10%.
Value [2], bit 4	0	Not in use.
Value [2], bit 5	0, 1	Wrong rotation.
Value [2], bit 6	0, 1	Wrong current direction.
Value [2], bit 7	0	Not in use.
Value [3], bit 0	0	Not in use.
Value [3], bit 1	0	Not in use.
Value [3], bit 2	0	Not in use.
Value [3], bit 3	0	Not in use.
Value [3], bit 4	0	Not in use.
Value [3], bit 5	0	Not in use.
Value [3], bit 6	0	Not in use.
Value [3], bit 7	0	Not in use.
Year	0,...,3000 (AD)	Not in use.
Month	0,...,12	Not in use.
Day	0,...,31	Not in use.
Hour	0,...,23	Not in use.
Minute	0,...,59	Not in use.
Second	0,...,59	Not in use.
Millisecond	0,...,999	Not in use.
Alarm limit	4 Bytes	Alarm limit, Always 0

5.1.4 LOAD PROFILE READING

The SCA supports load profile reading of ABB electricity meters with the load profile feature. Since load profile reading involves treatment of large amount of data, the ABB LonWorks PLC adapter cache the load profile for the last quantity that has been requested. The below scheme describes how to get the fastest possible reading time when reading load profile data.

1. Request and readout all desired load profile data for one quantity before reading another quantity.
2. Request and readout the load profile data with forward incremented time, e.g. 00:00, 01:00, 02:00..., when 60 minutes of interval for the load profile are used.

5.2 EXPLICIT MESSAGES

Explicit messages are supported by the ABB LonWorks PLC adapter for request and readout of Event log data. This is described by the tables below.

Request of Event log using explicit messages.

Field	Type/Length	Comment
Message Code	Byte	Quality log code (0x4C)
Time_Stamp_req	SNVT_time_stamp (= 7 Bytes)	Time from where to search log entries (year, month, day, hour, minute, second): entry having nearest starting time is written first in the response buffer and then other values (see next table:response)
Offset	2 Bytes	Offset to entry from time stamp. For example (assuming three entries per message): -10 = tenth, eleventh and twelfth entry before given time. -1 = three nearest before given time. 0 = three nearest after given time.

Readout of Event log using explicit messages.

Field	Type/Length	Comment
Message Code	Byte	Quality log code (0x4C)
Control	Byte	0x01 = Message OK. 0x02 = Error (too long response message); time stamp, length and status bytes not send. 0x03 = No log item(s) after (positive offset) or before (negative offset) requested time.
Time Stamp 1	SNVT_time_stamp (= 7 Bytes)	Starting time for nearest entry that matches request (year, month, day, hour, minute, second).
Length 1	4 Bytes	Duration of occurrence in seconds.
Status 1	1 Byte	Message type: 0 = Value not available 1 = Power cut. 2 = Phase 1 error. 3 = Phase 2 error.

		<p>4 = Phase 3 error.</p> <p>5 = Overvoltage +6% phase 1.</p> <p>6 = Overvoltage +6% phase 2.</p> <p>7 = Overvoltage +6% phase 3.</p> <p>8 = Undervoltage -10% phase 1.</p> <p>9 = Undervoltage -10% phase 2.</p> <p>10 = Undervoltage -10% phase 3.</p> <p>11 = Undervoltage -15% phase 1.</p> <p>12 = Undervoltage -15% phase 2.</p> <p>13 = Undervoltage -15% phase 3.</p> <p>14 = Wrong rotation.</p> <p>15 = Wrong current direction.</p>
Time Stamp 2	SNVT_time_stamp	Time stamp for the second Event log entry with the same format as Time Stamp 1.
Length 2	4 Bytes	Length for the second Event log entry with the same format as Length 1.
Status 2	1 Byte	Status for the second Event log entry with the same format as Status 1.
Time Stamp <i>n</i>	SNVT_time_stamp	Time stamp for the <i>n</i> th Event log entry with the same format as Time Stamp 1.
Length <i>n</i>	4 Bytes	Length for the <i>n</i> th Event log entry with the same format as Length 1.
Status <i>n</i>	1 byte	Status for the <i>n</i> th Event log entry with the same format as Status 1.

Note: The total message length is maximum 38 bytes including message code.

6 ABBREVIATIONS AND ACRONYMS

Explicit message	A message triggered explicitly by a NEURON or host application, whose content and time of transmission are defined by the application code.
LNS	Acronym for LONWORKS Network Services.
LON	Local Operating Network.
LONMARK	LONMARK Association: An independent organization of LONWORKS developers, system integrators, and end-users that define standards to ensure interoperability between LONWORKS devices from multiple manufacturers.
LONWORKS	Local Operations Network: A set of tools and devices forming a control network.
LonTalk	The protocol used on LONWORKS networks that standardizes communication. It defines the standard under which individual nodes exchange information.
LONWORKS NV	A network variable created using LonMaker for open LONMARK interoperability within the given application. In contrast to LONWORKS NVs, there are also NVs for communicating with the Distributed I/O Modules via autobinding.
NEURON Chip	A term derived from “neuron” (the cell) for an integrated circuit that contains a LON interface and permits the implementation of an application.
NeuronID	A 48-bit long identification number for each NEURON chip, burned in during its manufacture.
NV	Acronym for Network Variable on a LONWORKS system: NVs are high-level data objects that LONWORKS application nodes use to communicate with one another. The types, functions, and number of NVs are determined by the application code within the node.
SNVT	Acronym for Standard Network Variable Type. SNVTs facilitate interoperability by providing a well-defined interface for communication between nodes.
UNVT	Acronym for User-Defined Network Variable Type. UNVTs are application-specific Network Variable Types and are thus not SNVTs.
XIF	Acronym for External Interface File.

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