SGIM

Smart **G**rid **I**nterface **M**odul

The Smart Grid Interface Module (SGIM) is a ready-to-use system to monitor measured electrical values in switch cabinets and cable distribution cabinets. The mechanical design of SGIM is in line with industrial standards and is especially meant to be installed in a 185mm busbar system.

SGIM is built from two main parts: the installation platform and the plug-in unit. The plug-in unit contains all necessary control, communication and measurement functions to provide measured data either to a cloud-based data management system or via standard IEC protocols like IEEE 1815 - DNP3, IEC 60870-5-104 and IEC 61850 as well as industrial protocols like OPC/UA.

The device includes a local web server for the visualisation of the acquired data, the configuration of drivers and communication protocols as well as an interface to the WEB-PLC editor.

General Technical data

Size (W x L x H)	100 x 100 x 590 mm
Power supply Supplied via the SGIM installation platform	
Input voltage Lx – N:	230V (100V..240V) 50Hz
Power input L1:	⩽ 2990 VA + including Socket-outlet
Power input L2, L3:	< 0,1VA
Overvoltage category:	TN-C mains CAT IV | TN-C-S, TN-S or TT CAT III
Smart Grid Interface CPU module	
CPU:	IPC@CHIP® SC145 Embedded Controller
Operating System:	IPC@CHIP® RTOS-LNX Real-time operating system
Real-time clock:	Backed up by a lithium rechargeable battery Back-up duration > 10 weeks Expected battery lifetime > 10 years
Ethernet interface:	2 x 10/100BaseT, RJ45 connector, Link and traffic LED indicators
Serial interface:	1 x RS232/RS485 (selectable in software and by wiring), Weidmüller BL 3.50/08 connector Supported baud rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 Supply for external devices 24 VDC, 5 W
SD card interface:	1 x SD card, SD / SDHC, Push/push slot
Wireless interface:	Bluetooth 4.0
Environmental sensor:	Internal, temperature and humidity sensor
Temp. sensor range:	-40°C to +125°C
Temp. accuracy:	±0.2°C
Humidity sensor range:	0 %RH to 100 %RH
Humidity accuracy	±2 %

Electric specification

Measurement Voltage

Method:	L – N
Nominal Voltage:	230V/50Hz
Resolution:	0.01 V
Sampling rate:	A/D Sampling rate = 1.024 MHz
Value types:	current (average of the last 200 ms) Average, minimum, maximum: Reset after Transfer to the portal

Measurement Current RC

Method:	Rogowski coils (RC)
Input RC:	22,5mV / kA
Resolution:	0.01 A
Metering range:	0..15kA
Sampling rate:	A/D Sampling rate = 1.024 MHz
Value types:	current (average of the last 200 ms) Average, minimum, maximum: Reset after Transfer to the portal

Measurement Current CT

Method:	Current transformers (CT)
Input CT:	1A Transfer ratio is configurable by user (xxx:1)
Resolution:	0.1 A
Metering range:	Secondary: 0..1A Primary: depending on transfer ratio
Impedance:	typ. 250 mOhm
Sampling rate:	A/D Sampling rate = 1.024 MHz
Value types:	current (average of the last 200 ms) Average, minimum, maximum: Reset after Transfer to the portal

Functional parameters

Functional parameters for 50Hz, without sensors. The parameters are applicable for both RC and CT measurements.

The parameters are determined based on EN 61557-12:2008:

Table 43:

Type of Characteristics	Characteristics value	Other complementary characteristics
Power quality assessment function (if any)		
Classification of PMD according to 4.3	PMD-SD	
Temperature	K55	
Humidity + altitude		
Active power or active energy function performance class	0,5 (active power) 2 (active energy)	

Table 44:

Function	Symbol	Precision class	Metering range
Active power	P	0,5	2,3 W..10,35 MW (RC) 2,3..230 W (CT)
Reactive power	Q_A, Q_V	1	2,3 W..10,35 MW (RC) 2,3..230 W (CT)
Apparent power	S_A, S_V	0,5	2,3 W..10,35 MW (RC) 2,3..230 W (CT)
Active energy	E_a	2	3.402823 × 10^38 kWh
Reactive energy	E_{rA}, E_{rV}	3	3.402823 × 10^38 kvarh
Apparent energy	E_{apA}, E_{apV}	2	3.402823 × 10^38 kVAh

Frequency	f	0,5	45-55Hz
Current	I	0,5	0,01..15 kA (RC) 0,01..1A (CT)
Measured neutral current	I_N	n.a.	
Computed neutral current	I_{nc}	n.a.	
Voltage	U_{L-N}	0,5	90..260 VAC
Power factor	PF_A, PF_V	0,5	0..1
Flicker	P_{st}, P_{lt}	n.a.	
Voltage dips	U_{dip}	n.a.	
Voltage increases	U_{swl}	n.a.	
Transient overvoltages	U_{tr}	n.a.	
Voltage interruptions	U_{int}	n.a.	
Voltage unbalance	U_{nba}, U_{nb}, U_h	n.a.	
THD of the voltage	THD_u	n.a.	
THD of the voltage	$THD\text{-}R_u$	n.a.	
Mains signal voltage	M_{sv}	n.a.	

Module

Smart Grid Interface Radio module

SIM card:	Mini SIM card slot (2FF)
Antenna interface:	SMA female
Mobile protocols:	GSM / GPRS / EDGE / UMTS / HSPA+

Service section

Socket-outlet:	connected to L1 and N, one switched by rocker switch.
Socket type:	2 Sockets Type J (SEV1011 - T13) with CTE.SGIM.BASE.AJ 2 Sockets Type F (CEE 7/3) with CTE.SGIM.BASE.AF
Voltages taps:	5 x 4 mm laboratory sockets connected to L1 – brown L2 – black L3 – grey N – blue PE – yellow/green

Smart Grid Interface media converter module

Ethernet interface:	10/100BaseT, RJ45 connector, Link and traffic LED indicators
Fiber optics Interface:	100BASE-LX10, E2000 connector, Link and traffic LED indicators

Smart Grid Interface IO module

Input channels:	8
Input characteristics:	sourcing, 12 VDC, isolated against the system, not against each other
Output channels:	2
Output characteristics:	Relay, 230 VAC: 5A (NO), 3 A (NC) 30 VDC: 5A (NO), 3 A (NC)

Smart Grid Interface Measuring module for 3 x L Rogowski sensors (RC)

Measuring channels:	2 (per module)
Measuring mode:	3-phase measurement, L1/L2/L3
Sensor:	Smart Grid Interface Rogowski coil set - SGIM-MU-3RC-D70-170CM

Smart Grid Interface Measuring module for 3 x L current transformers (CT)

Measuring channels:	2 (per module)
Measuring mode:	3-phase measurement, L1/L2/L3
Sensor	Only for current transformers with secondary currents of max. 1 A

Smart Grid Interface Measuring module for 3 x L + N Rogowski sensors (RC)

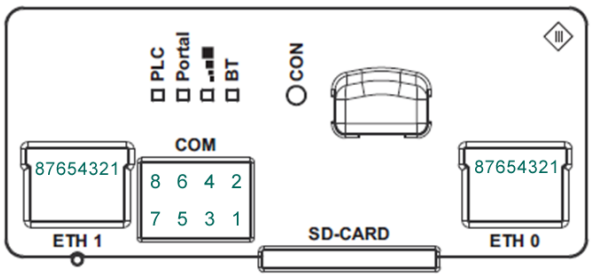
Measuring channels:	1 (per module)
Measuring mode:	3-phase measurement, L1/L2/L3 plus neutral conductor
Sensor:	Smart Grid Interface Rogowski coil set - SGIM-MU-3RC-D70-170CM Smart Grid Interface Rogowski coil set xxxxx

Smart Grid Interface Measuring module for 3 x L + N current transformers (CT)

Measuring channels:	1 (per module)
Measuring mode:	3-phase measurement, L1/L2/L3 plus neutral conductor
Sensor	Only for current transformers with secondary currents of max. 1 A

Connector descriptions

Smart Grid Interface CPU module



ETH0, ETH1

Pin	Function
1	Tx+
2	Tx-
3	Rx+
4	n.c.
5	n.c.
6	Rx-
7	n.c.
8	n.c.

COM

Pin	Function
1	GND
2	RS232 CTS
3	RS485 B (+)
4	RS232 TXD
5	RS485 A (-)
6	RS232 RTS
7	24 VDC (out)
8	RS232 RXD

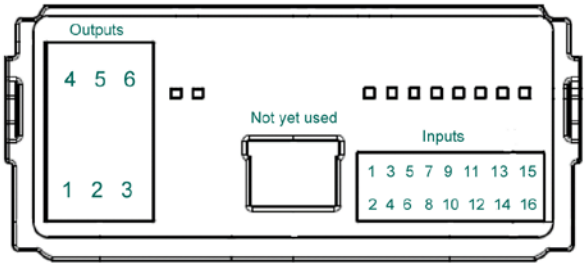
Smart Grid Interface Measuring module for Rogowski sensors (RC)

Pin	Function
1	I L1
2	N
3	I L2
4	N
5	I L3
6	N
7	Cable detect

Smart Grid Interface Measuring module for current transformers (CT)

Pin	Function
1	I L1
2	N
3	I L2
4	N
5	I L3
6	N
7	Cable detect
8	N
9	not populated

Smart Grid Interface IO module



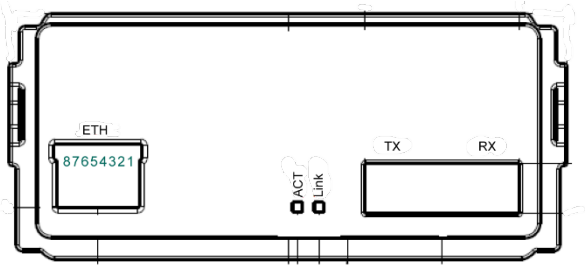
Outputs

Pin	Function
1	NC0
2	COM0
3	NO0
4	NC1
5	COM1
6	NO1

Inputs

Pin	Function
1	IN0
2	INPUT-GND
3	IN1
4	INPUT-GND
5	IN2
6	INPUT-GND
7	IN3
8	INPUT-GND
9	IN4
10	INPUT-GND
11	IN5
12	INPUT-GND
13	IN6
14	INPUT-GND
15	IN7
16	INPUT-GND

Smart Grid Interface media converter module



Pin	Function
1	Tx+
2	Tx-
3	Rx+
4	n.c.
5	n.c.
6	Rx-
7	n.c.
8	n.c.

Software

Operating System
IPC@CHIP® RTOS-LNX Real-time operating system

WEB-PLC editor and runtime
- Visual programming editor running on the internal web server
- Quick I/O mapping editor
- Up to 1024 I/O values
- Up to 256 portal variables

WEB-PLC diagram
- Up to 512 function units, I/O values, portal variables and constants
- IPO cycle time: 10ms to 1000ms

WEB-PLC function units
Data type converters:
- Bool, Uint8, Sint8, Uint16, Sint16, Uint32, Uint64, Sint32, Sint64, Float32, Float64, String

Binary:
- AND, OR, XOR

Bits and bytes:
- Extract, Pack, Put Bit, Shift Register, Unpack
- Controllers: On/Off, P, Shade

Messages:
- Send, Receive

Numerical:
- Addition, Subtraction, Multiplication, Division, Minimum, Maximum, Min Acc, Max Acc, Average, Counter, Compare, Signal Limiter, Signal Converter, Signal Smoother, Signal Tracker

Special:
- First Cycle, OpenVPN, Portal Status Storage, Selection, Edge Detection:
- Demultiplexer, Multiplexer, RS Flipflop, T Flipflop, Trigger, Analog Trigger, Load Profile, State Machines

Timing:
- Local Clock, Local Clock Timer, UTC Clock, UTC Clock Timer, Stop Watch, TON, TOFF, TP, Timer, Compare Time, Time Switches

com.tom PORTAL communication
Transferred information:
- Device information
- Portal round trip times
- Update URL, trigger and status
- OpenVPN activation and status
- Event log messages
- I/O values
- Portal variables

WEB-PLC additional functions
Event log:
- System events are logged to a circular buffer in RAM with timestamp, message and event type Simple Network Time Protocol (SNTP) synchronization of the system clock

OpenVPN client:
- Integrate the com.tom device into a virtual private network

DHCP server:
- Up to 100 clients, up to 20 static leases

NAT:
- Route traffic between a local (internal) and a global (external) network, up to 1000 mappings, up to 50 static mappings

Firewall:
- Filter incoming traffic, up to 1000 rules (including dynamic rules for outgoing traffic), up to 50 static rules

Messages:
- Send and receive short messages (up to 10 templates respectively)

Modbus RTU master/slave:
- Up to 32 devices and 512 values (up to 1024 values including array members)

Modbus TCP client/server:
- Up to 32 devices and 512 values (up to 1024 values including array members)

CODESYS network variables:
- Up to 32 lists and 512 values

SNMP manager:
- Up to 32 agents and 512 values Trap receiver

COM server:
- According to RFC 2217

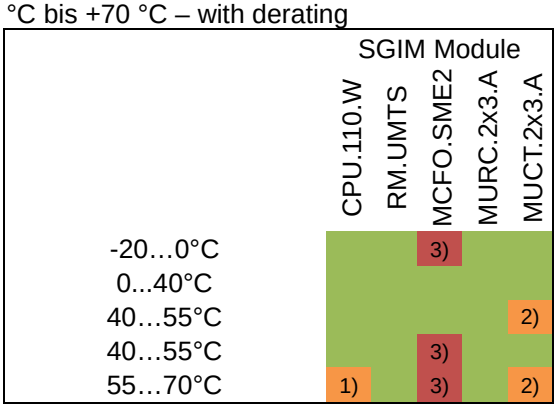
Time switches:
- Up to 8 switches, crontab format

MicroBrowser interface
Local or remote installation of updates (firmware or configuration)
Export:
- Export the diagram and/or the settings of the com.tom device as an update package

OPC-UA server
Micro Embedded Device Server Profile - User Token – User Name Password Server Facet - SecurityPolicies – None, Basic128Rsa15, Basci256Sha256 - UA-TCP UA-SC UA-Binary - Embedded DataChange Subscription Server Facet Up to 32 groups, 512 values, 1024 scalar values or array elements Up to 4 concurrent client connections

Environmental data

Rated operating temperature range	K55 (−5 °C bis +55 °C)
Operating temperature	−20 °C bis +70 °C – with derating



1) no supply of external modules via serial connector
2) Maximum 4 modules
3) Not permitted
No restriction

Transport and storage temperature	−25 °C bis +70 °C
Relative humidity	0 % bis 90 % RH, without condensation
Operating altitude	0 % bis 90 % RH, without condensation
Mounting position	Vertical, only with SGIM installation platform
Protection rating	IP21
Protection class	Smart Grid module II; Service section: I

Conformity

SGIM conformity to EU regulations and standards

EMC Directive 2014/30/EU **Emission - EN 55032**	Radiated Emission HF-Field - Class B Conducted Emission - Class A
Immunity - EN 61326-1	EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11
Radio Equipment Directive (RED) 2014/53/EU	ETSI EN 301 489-1 V2.1.1 ETSI EN 301 489-17 V2.2.1 ETSI EN 300 328 V2.1.1 ETSI EN 301 511 V12.5.1 ETSI EN 301 908-1 V11.1.1 ETSI EN 301 908-2 V11.1.2
Low Voltage Directive 2014/35/EU	EN 61557-1, EN 61010-1
Restriction of Hazardous Substances (RoHS 2) Directive 2011/65/EU	
Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation 1907/2006 (REACH)	