

GRTU-6K
MV/LV substation automaton - 6 channels

The **GRTU-6K** (Gillam Remote Terminal Unit – 6 channels) is a modular automaton intended for supervision and control of medium and low voltage distribution networks (MV/LV).

The **GRTU-6K** allows complete supervision and remote control of a MV/LV distribution substation.

The modular design of the **GRTU-6K** offers the possibility to adapt its functionality to the specific needs of each MV/LV substation within a single and same equipment.

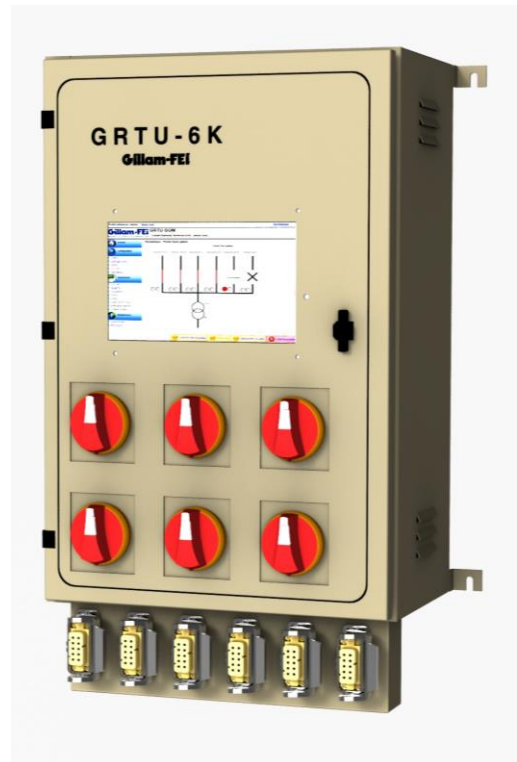
HN64-S-43 standardised electrical control interfaces allow quick connection to MV switches (other connections on request).

The **GRTU-6K** integrates advanced measurement functionalities and faults detection. It brings to operators new solutions to improve the network's availability and the network's energy efficiency. New monitoring solutions take into consideration the problems raised by local generation (photovoltaic, wind power, ...).

Uninterrupted Power Supply guarantees operation and switchgear control during power outages.

The **GRTU-6K** supports modern communication channels such as Ethernet, GPRS, 3G, xDSL, ...

Supervision
Control
Fault detection
Measurement



- 24 digital inputs (for switchgears monitoring)
- 16 additional digital inputs on 16DI card



- 6 IN/OUT complementary digital outputs. Secured and lockable
- 8 additional bistable digital outputs on 8DO card



- MV resistive fault detection
- Amperometric fault detection
- Directional fault detection
- Slow overload detection on LV transfo



- LV multimeter : U, V, I, P, Q, cos ϕ , ...
- MV multimeter : U, I
- Ambient and transformer temperature
- 1 month archiving period

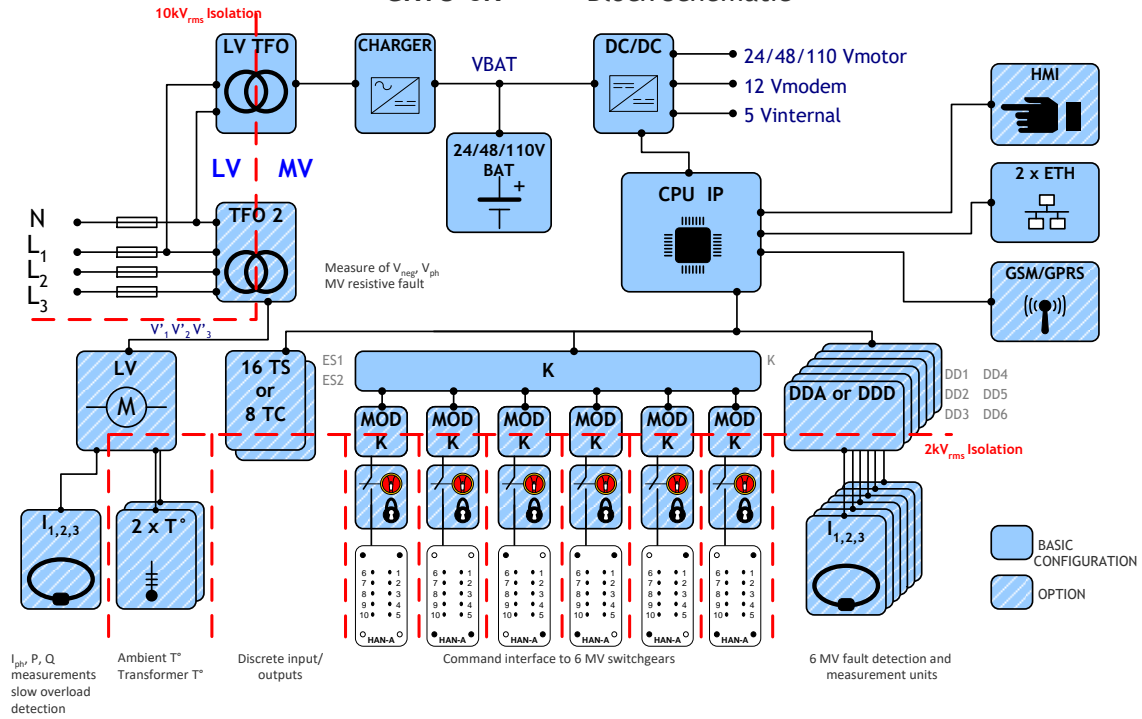


- 2 Ethernet ports
- GPRS / 3G
- CE1104 communication
- WEB configuration interface
- Cybersecurity functions



- 24/48/110V scalable energy workshop
- >22 hours / 10 switchings autonomy
- Battery test
- Charging voltage is temperature compensated

GRTU-6K - Block Schematic



Energy workshop

It is responsible for batteries charging and provisioning of the different required voltages :

- 24/48VDC for HN64-S-43 motor command (110VDC available upon request),
- 5VDC for equipment's internal power supply,
- 12VDC protected against excessive loads to supply an external communication equipment.

To preserve battery life, charging voltage is temperature compensated. A deep discharge protection and a protection against cabling reversal are also integrated into the equipment. Batteries are automatically tested monthly or on user's request.

Alarms are generated in case of charger failure or lack of power supply.

6 channels supervision / control

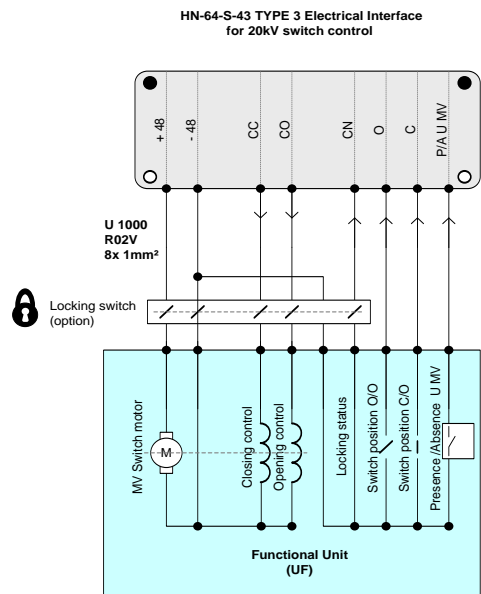
The **K** card and its **MOD 1K** relay modules form the electrical control interface for MV switch. 6 keyed 10 polarities connectors compliant with specification HN64-S-43 allow connecting 6 UF (functional units). Each switch has :

- its 24/48VDC power supply for motor command,
- opening/closing controls,
- reading of O/C position, of locking control and MV voltage presence/absence.

For switch models not equipped with regulatory locking mechanism the latter can be integrated on the equipment's front panel. Additional channels and locking panels can be equipped on site.

These connectors are located on the interface panel located on the lower side of the enclosure.

The electrical interface is customizable upon request.



MV faults detection

6 slots (DD1 to DD6) are available for MV faults detection cards, according to substation neutral earthing :

- Amperemetric cards (DDA) HN45-S-50 (February 2012) for impedance grounded networks. Settable delayed thresholds for residual current and phase current.
- Directional cards (DDD) HN45-S-51 (February 2012) for resonant (compensated) or impedance grounded networks. Upstream/downstream Localization of single phase fault. Settable delayed threshold for residual current and phase current.

Negative sequence voltage is calculated from LV three-phase voltage for MV resistive faults detection (requires LV card and TFO2 measurement transformer). The detection is based on the crossing of a settable delayed voltage threshold.

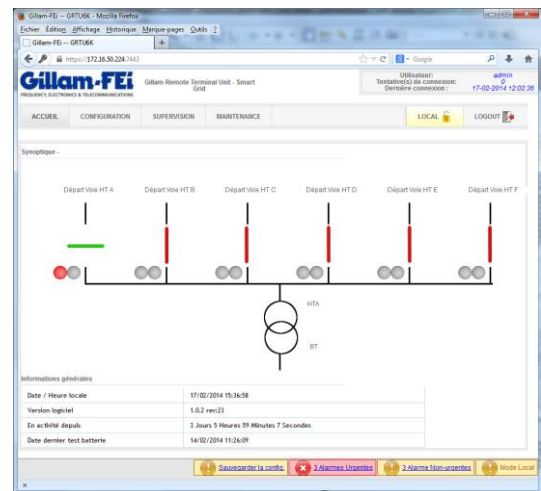
Negative sequence voltage calculation completes MV faults detection range whenever residual current is lower than setting of related feeder protection (faulted conductor, broken connection, fallen cable, ...).



Web interface

All configuration, supervision and maintenance functionalities can be accessed through a standard WEB browser :

- Definition of several users with role-based permissions
- Visualization of all information collected by the automaton
- Setting of the different functions
- Browse and export of archived measures
- Equipment configuration import / export
- Software update through WEB interface
- Alarms list
- Timestamped logbook
- Communication traces



Cybersecurity

The use of Ethernet based communication in substation environment raises the focus on cybersecurity. Threats are evolving as well as standards. GRTU-6K is hardened to provide a robust solution for today as for the future :

Physical access restriction

At the base of the protection scheme, a key lock prevents from physical connection within the equipment.

Robust OS

Linux OS is robust by design and less prone to virus spread.

User account management

Password-protected user authentication is required for connection to the equipment.

User account

Several users with dedicated passwords can be created, modified and deleted.

Role based access control

Each user is assigned a role, which grants access to restricted functionalities.

Account inactivation

An account can be locked after unsuccessful attempts to login. At login, the user is shown the login history with date and number of unsuccessful login attempts.

HTTPS support

Encrypted communication can be forced for the Web management interface. Using a standard browser, the communication can be *http://* or *https://*. It is possible to use the standard self-signed certificate or to import a third-party generated certificate.

Encryption of passwords

Passwords list is encrypted.

Local logging

A logbook is generated containing date, time, user login, logout and security activities.

Timestamping

IEC60870-5-104 messages are timestamped. Built-in time synchronization service (NTP client and server) enables timestamps validation.

Remote software update

Cybersecurity is an increasing topic for electric utilities. As future security threats are by nature hardly predictable, our development team is committed to adapt its product to provide the most up-to-date solutions.

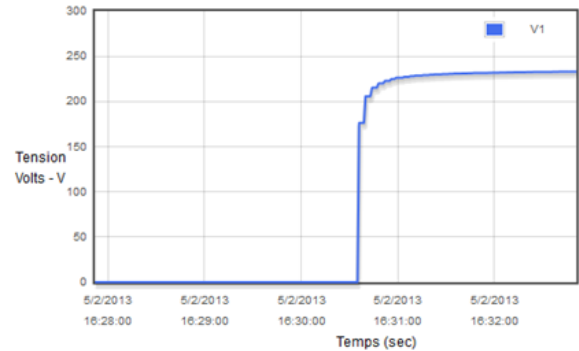
MV measurement

The **GRTU-6K** has a long-term (min. 1 month) archiving function of average measured values. Measurements acquired by fault detection cards are available for consultation on the WEB interface or are sent to SCADA system. The 3 phase currents and the residual current are measured. In addition DDD cards provide the 3 phase voltages and the residual voltage.

LV measurement

The **LV** card achieves the measurement of the 3 phase currents. It accepts Rogowski and CT inputs. When the extra-insulated measurement transformer (**TFO2**) is installed, three-phase voltages are also measured. Available measurements are :

- I1, I2, I3, Ir, ΣI ,
- V1N, V2N, V3N, Vneg, U12, U23, U31,
- For each phase : P, Q, $\cos \phi$ + total P, Q,
- 2 PT100 inputs for 2 temperature probes.



16 insulated digital inputs (16DI) card

In addition to switchgear dedicated inputs, up to two 16 insulated digital inputs cards can be inserted for remote signalling of various contacts (take place in ES1 and ES2 slots).

8 insulated digital outputs (8DO) card

8 (bistable) digital outputs cards are also available for remote controls (take place in ES1 and ES2 slots).

Communication

The **GRTU-6K** supports the IEC60870-5-104 protocol to communicate with the supervision centre. 2 Ethernet 10/100 base-T ports with separate addresses allow establishing a possible redundant connection. Optional advanced communication capabilities :

- GSM/ GPRS modem for IEC104 transmission,
- 3G with firewall, router, VPN for complete remote access,
- Fiber media converter, xDSL media converter, ...
- Radio, leased line modem (serial),
- Wi-fi (to wirelessly access WEB interface by means of a tablet).

Synoptic selection

Gillam-Fei		Gillam Remote Terminal Unit - Smart GRID		User: web
				TY: 0
				Last connexion : 18-02-2014 12:09:06
Local time	18/02/2014 12:13:44			
Software version	1.0.2 rev:23			
Uptime	4 Days 2 Hours 36 Minutes 53 Seconds			
Latest battery test	14/02/2014 11:26:09			
Alarms list				
DATE - HOUR	CARD	OBJECT	ALARM	STATE
14/02/14 11:27:12.319	CUIP	Task SERVER1 CEI104	NON-URGENT	Default
13/02/14 16:47:49.033	BT	Etat carte	URGENT	Absent
12/02/14 14:56:41.531	CUIP	Défaut Résistif	URGENT	Présent
12/02/14 14:56:41.531	BT	Absence Sonde Cuve	NON-URGENT	Présent
24/01/14 16:58:43.003	CUIP	Batterie en charge	URGENT	Présent
16/01/14 08:52:19.906	CUIP	Poste Local	NON-URGENT	Actif

Touchscreen synoptic (option)

2 types of Human-Machine Interfaces are proposed :

- WEB interface (always available)
- *Optionally* : *touchscreen* synoptic

The *touchscreen* synoptic is placed on the **GRTU-6K** front panel with lockable access. It includes WEB interface functionalities, that can be accessed locally.

3 levels of physical access are available :

- level 1 : visualization
- level 2 : visualization and action
- level 3 : maintenance access

Automatic controls (as source permutation, switch automatic shedding,...) are available optionally.

Current probes

Phase current measurement and amperometric/directional faults detection is realized by means of « Rogowski » type current probes. These flexible probes can be installed easily and are safe of any dangerous potential at their terminals. A mounting brace is provided for installation on insulated cable. A range of CT is also available for metering.



Voltage probes

MV voltage measurement required for directional detection (DDD) operation is realized by means of capacitive sensors (PPACS) to be placed on MV electrical outlets.



Light box

An IP66 light box allows signalling Red/Green information coming from the fault detection card.

Temperature probes

PT100 probes in wall mount version or adhesive silicone for mounting on transfo.

Locking switch

Mounted optionally on the GRTU-4K door, this lockable switch allows blocking of the electrical control associated to a switchgear channel.

Communication

Protected auxiliary supply is provided for a broad range of external communication devices (media converter, modems, firewall/routers, ...).

Main features

LV power supply

Input voltage	230VAC +-15%
Max voltage	400VAC (10 minutes)
Consumption	< 100 Watts
Insulation transfo	Primary-secondary screen Grounded secondary
Protection	HPC fused switch disconnector

VPN (option)

IPSec, OpenVPN
On external router

Firewall (option)

On external router

SCADA communication

Protocol	IP: IEC60870-5-104 Serial: IEC60870-5-101 (opt)
Clock synchronization	Through 104 protocol NTP Client and Server
Communication (standard)	2 x 10/100 base-T Ethernet
Communication (option)	GPRS 3G (single or dual sim) Radio / Leased line Fiber optics / xDSL Wi-Fi 802.11

Energy workshop

Input voltage	230VAC +-15%
Batteries	Sealed lead-acid 24V: 2x12V 17Ah 48V: 4x12V 7.2Ah up to 18Ah 110V: upon request
Primary-secondary insulation	10kV _{RMS} / 20kV _{surge} Grounded secondary
Temperature compensation	-3.3 mV / °C / cell
Deep discharge disconnection	If V _{bat} < 46 V (48V version)
Battery voltage alarm	If V _{bat} < 42V (48V version)
Autonomy (48V)	4x7.2Ah : 9 hours + 10 sw. 4x18Ah : 22 hours + 10 sw.
Battery fault alarm	On inconsistent battery test
Battery test	Monthly or on request
Polarity reversal Protection	Bypass diode 5x20mm cartridge fuse Fuses are monitored
Modem auxiliary voltage	12VDC Limited to 2A / 3 min

Security

Authentication	User account management Role based access control Account inactivation Logbook
Encryption	https support. Self-signed or 3 rd -party certificate

Modular slots

ES1, ES2	16DI, 8DO cards
DD1, ... DD6	DDA, DDD cards
K1, ... K6	K Module (1 per switchgear)
BT	LV card
TFO2	TFO2 module
GPRS	GPRS module
3G	GPRS/3G router firewall

MOD K card

Double command	1
Command security	Built-in Select before Operate
Signal input	4

HN64-S-43 electrical control for switchgear (for custom interface : contact us)

Connector	Harting HAN-A 10 poles
Control	TC connector- Type 3
Switch motor power supply	48VDC Nom 5A / 7s Surge 15A / 50ms
O/C electrical control	100mA / 3s
Signals	48Vdc dry contacts Open switch, Closed switch Neutralised control, U presence

16DI card

Inputs	16
Insulation	Opto-coupler
Signalling voltage	24VDC (generated by the card)
Filtering	24 ms
Connector	Pitch of 5.08mm. Removable. Push-in direct insertion. 1 terminal per input + 8 negative commons.

8DO card

Outputs	8
Insulation	Electromechanical relays
Relay type	Bistable
Switchable nominal current/voltage	8A / 250Vac 8A / 30 Vdc
Connector	Pitch of 5.08mm. Removable. Push-in direct insertion. 2 terminals per output contact.

DDA card

Measurements	I1, I2, I3, Ir
Standard	HN 45-S-50 (February 2011)
Single phase fault detection threshold (Ir)	Adjustable between 80 and 160A (80A by default)

Double fault detection threshold (Ir)	Adjustable between 500 and 1600A (500A by default)
Polyphase fault detection threshold	Adjustable between 250 and 1200A (450A by default)
Fault detection delay	Adjustable between 20msec and 3s
Voltage presence	Realized by LV card

DDD card

Measurements	I1, I2, I3, Ir V1, V2, V3, Vr
Standard	HN 45-S-51 (February 2011)
Single phase fault detection threshold (Ir)	Transient analysis Set 1 / Set 2
Double fault detection threshold (Ir)	250A during 80ms
Polyphase fault detection threshold	500A during 80ms
Voltage presence MV voltage	Measured by the PPACS 15kV / 20kV On site calibration

LV card

Measurements	I1, I2, I3, I0, I _T U ₁₂ , U ₂₃ , U ₃₁ V1, V2, V3, Vi P1, P2, P3, P _T Q1, Q2, Q3, Q _T cos φ ₁ , cos φ ₂ , cos φ ₃ T _{amb} , T _{tfo}
V configuration supported	4 poles 3 poles (artificial neutral is reconstructed)
Voltage range	0-400V (phase-neutral)
Accuracy	0-700V (phase-phase) <0.5%
Current range	25...2000A
Accuracy	<1% (excluding CT)
Power range	-1380 to 1380 kW / kVA
Accuracy	Class 3 (NF EN60044)
Long-term archiving	1 sample/min (1 month) 1 sample/15 min (1 year)
Short-term archiving	1 sample/s (10 min)
Average values	Settable duration from 60 to 3600s
Voltage absence	V < 70V during 5s
Cable overload	settable threshold on I _{phase,aver}
Transfo overload	settable threshold on ΣI _{phase,aver}
MV resistive fault threshold	Settable from 9.2 to 46V
MV resistive fault delay	Settable (> 400ms)

Rogowski current probe

Secondary voltage	$V(t) = -M di/dt$ 100mV for 1000A 50Hz
Bandwidth	20Hz – 5kHz
Linearity error	-
Positioning error	-
External field influence	< 0.5%
Accuracy	Calibration factor to be entered (refer to card)
Internal diameter	120 mm
Electrical insulation	7400 V _{50Hz, 1min}
Cable	Available in 7m, 12m

Capacitive voltage probe

Specification	HN 52-S-63
Rated voltage level	24 kV
Accuracy	+/-15 %
Calibration	On site voltage balancing
Cable	Available in 7m, 12m

Light box

Dimensions (Lxwxh)	97 x 97 x 54 mm
Box	Polycarbonate. Wall mount.
Cable	Available in 7m, 12m
Protection degree	IP66

Dielectric strength

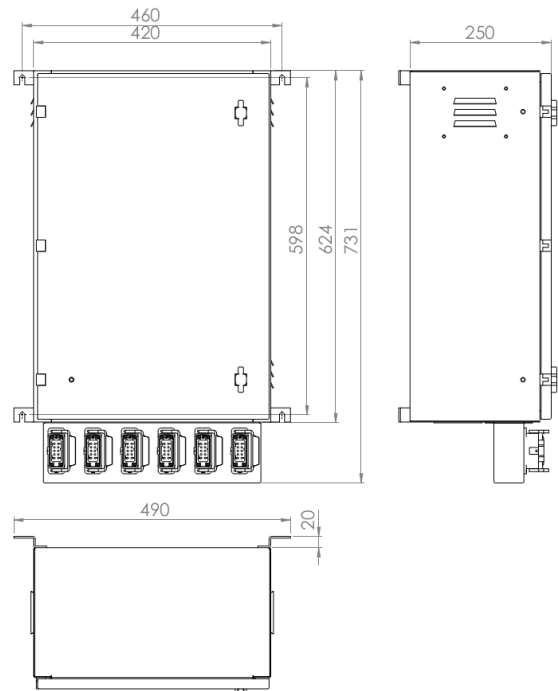
AC supply	CM : 10kV _{RMS} / 20kV _{surge} DM : 8kV _{surge}
Galvanically independent circuits	CM : 2kV _{RMS} / 5kV _{surge} DM : 1kV _{RMS} / 3kV _{surge}

Environment

Dimensions (Lxwxh)	700 x 300 x 300 mm
Box	Painted steel
Access	Lockable door
Operation conditions	-15°C to + 55°C Humidity < 95% 40°C
Storage conditions	-25°C to +70°C -40°C to +70°C

Applicable Standards

HN 45-S-50	
HN 45-S-51	
IEC 60870-5-104	Network access for IEC 60870-5-101 using standard transport profiles
NF EN 61000-4-2	ESD : 8 kV contact /15kV air
NF EN 61000-4-3	RFI : 27MHz-6GHz 30V/m
NF EN 61000-4-4	EFT : sensors, LV 4kV / other 2kV
NF EN 61000-4-5	1.2/50 : 2kV CM / 1kV DM
NF EN 61000-4-6	RFC : 0.15-80MHz 10V
NF EN 61000-4-8	Magn. field 50Hz Level 5
NF EN 61000-4-9	Magn. field impuls. Level 5
NF EN 61000-4-16	LFC : 0-150kHz 30V / 300V 1s
NF EN 61000-4-18	Damped oscillatory wave 2.5kV CM 1kV DM



For any specific request (connectors, voltage, electrical characteristics, ...) please contact GILLAM.