



Compatible[®]
ZIVersys



1RTN

Transformer Voltage Regulator
Automatism, Control, Measuring and Communications



Description

RTN terminal units are powerful, microprocessor-based automatic control units that incorporate various functions for power transformer voltage regulation via , tap changer control.

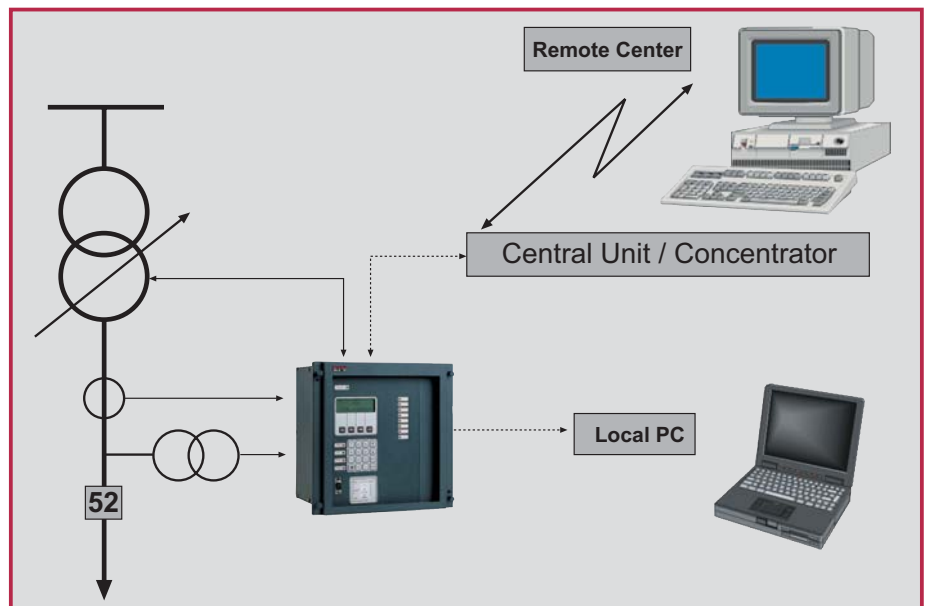
Each terminal unit can be used either individually or can be integrated in larger system together with other Intelligent Electronic Devices (IEDs). In either case, terminal units are provided with local and remote communication ports.

When the **RTN** is incorporated in a Substation Integrated Protection and Control System (SIPACS), the connection to the substation Central Unit is made through its communication subsystem. The Central Unit is responsible for external connections and, if needed, emulates the required RTU communications protocol.

Application

RTN terminal units are designed for applications where constant voltage level must be maintained, without service interruptions, by adjusting the tap changer of a power transformer.

Voltage is regulated from the current and voltage power transformer output values, through the voltage and current instrument transformers, by sending corresponding orders to the tap changer for raising/lowering voltage to the setpoint value.



Functions

Voltage regulation

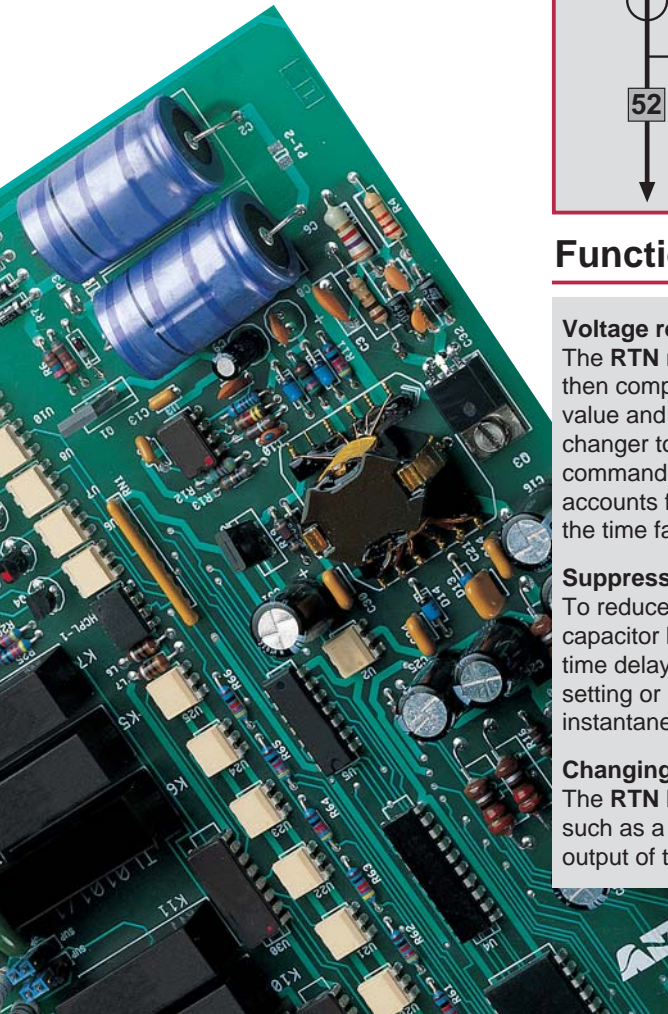
The **RTN** measures the voltage output of the power transformer. This measure is then compared to the setpoint value. When the difference between the measured value and the setpoint exceeds the threshold setting, a command is sent to the tap changer to lower or raise the tap according to the calculated voltage difference. The command generation is dependent on a time characteristic. This time characteristic accounts for the voltage deviation value, and the settings of the threshold value and the time factor.

Suppression of Time Delay in Operations

To reduce overvoltage during operations such as the connection or disconnection of capacitor banks, **RTN** terminal units can eliminate the time delay characteristic. The time delay can be suppressed by monitoring the voltage signal in comparison with a setting or by a digital input. In both cases, the tap changer command is generated instantaneously.

Changing the Compound Slope

The **RTN** has the capability of modifying the compound slope to anticipate situations such as a parallel connection of a second power transformer that reduces the current output of the first transformer by 50% while the load remains unchanged.



Functions

Reactive Power Compound

The RTN incorporates a second current input from a parallel power transformer for measuring the reactive power flux circulating between both transformers. This scheme allows voltage variation calculations to be adequately corrected.

Blocking of Regulator

The RTN can be externally blocked via a contact input, or internally blocked due to undervoltage or overcurrent conditions.

Setpoint value selection

The voltage setpoint value can be modified via the HMI (RS and LS keys), contact inputs, or settings. Tap changers monitoring and signaling (optional).

Local/Remote Control

The local or remote control of the setpoint value can be modified via the (L/R key).

Automatic/Manual Operation

Automatic or manual tap changer operation mode can be selected via the HMI, contact inputs, or communications.

Manual Operations

It is possible to manually raise or lower the tap via HMI, contact inputs or communications.

Tap Changer Monitoring and Signaling

Monitoring is performed on the tap at which the regulator is positioned. After a tap change, an output signal (0-5mA) is generated to remotely display the tap position. Additionally, an alarm signal is triggered in any of the following cases: absence of an active tap, more than one active tap and extreme tap.

Analog Indications

Besides the analog output to indicate tap changer position a second output (0-5mA) indicates setpoint value adjusted.

Voltage Band Recorder

RTN units are equipped with a user adjustable data recorder that logs the voltage duration in seven different operating bands.

Human-Machine Interface


The RTN Human Machine Interface can be accessed in two different ways:

• Local Access:

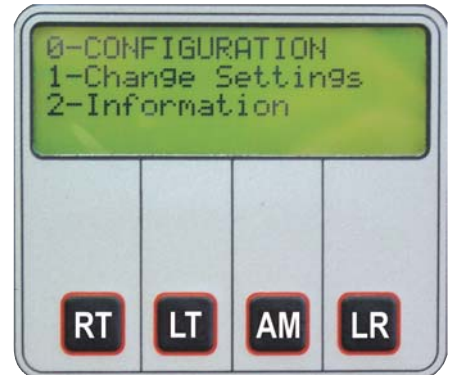
1. Keypad & Display. The RTN keypad (16 keys in a 4 x 4 matrix plus 4 function keys) provides the user menu-driven access to, and edition of, nearly every function and setting in the IED. Sensitive operations are password protected. This feature allows changes to be performed without the use of a computer. The display is an LCD type with 20 x 4 character matrix. The default screen in the unit provides the following information:

- Measured voltage
- Voltage setpoint value
- Tap Changer Position (optional)
- Voltage in range / Voltage out of range

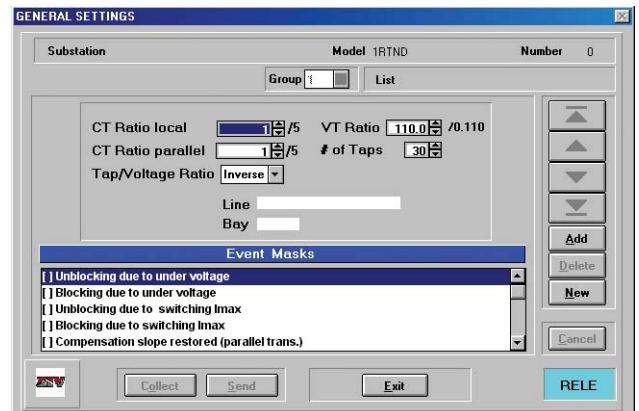
The 4 dedicated function keys are used to raise and lower the set point value, change between automatic and manual mode, and change between local and remote mode.

2. Local PC. The RTN terminal unit is provided with an RS-232 front port to allow local communication to a PC via a null modem cable. The IED can be accessed with the user-friendly  software package.

• Remote Access. The RTN is provided with a rear communications port. Depending on the model selection the rear port can be RS232 type, plastic fiber, or glass fiber. This connection permits remote access via modem, or it can be used to include the RTN in an existing system (via RTU, Substation Central Computer or SCADA).



Close view of display



Assistance in U.S.A.
and Canada.





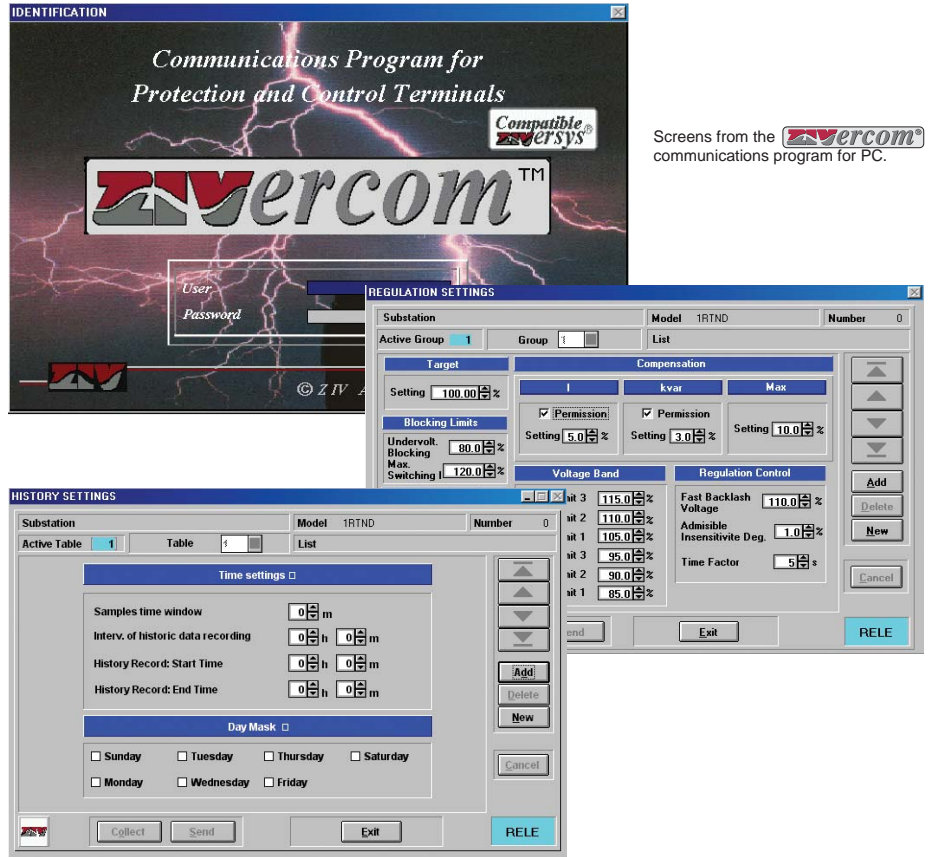
Communications

The **vercom**® communications software program communicates directly with all types of **ZIV** terminal units either locally (via front port), or remotely (via serial port).

The **vercom**® software package allows the user access to settings, local operations, input and output programming and data records. The program is password protected and can designate various levels of access to individual users.

vercom® is an intuitive, Windows TM based program. The structure of the software consists of menus and graphical user interface dialogs boxes. Each sub-menu prompts the user to enter data or make a selection among different options.

vercom® allows the user to program settings off-line. The information can be easily stored in the software database to be uploaded to an IED in the future.



Screens from the **vercom**® communications program for PC.

Enclosure

Cabinet mounted **RTN** terminal units are designed for a ½ of a 19" rack and are 6 standard units tall.

Screw connection system terminal blocks are used to accept analog inputs (up to 11 AWG) and digital inputs and outputs (up to 14 AWG).



System incorporating different protective relays in a 19" rack

Protection Settings

General Settings

CTLocal Ratio	1 - 20000/5A
CT Paralell Ratio	1 - 20000/5A
VT Ratio	1.0 - 440.0/0.110 (Vn = 110 Vca)
	1.0 - 440.0/0.120 (Vn = 120 Vca)
Number of Taps	2 - 30
Tap Voltage Ratio	Direct / Inverse

Regulation Settings

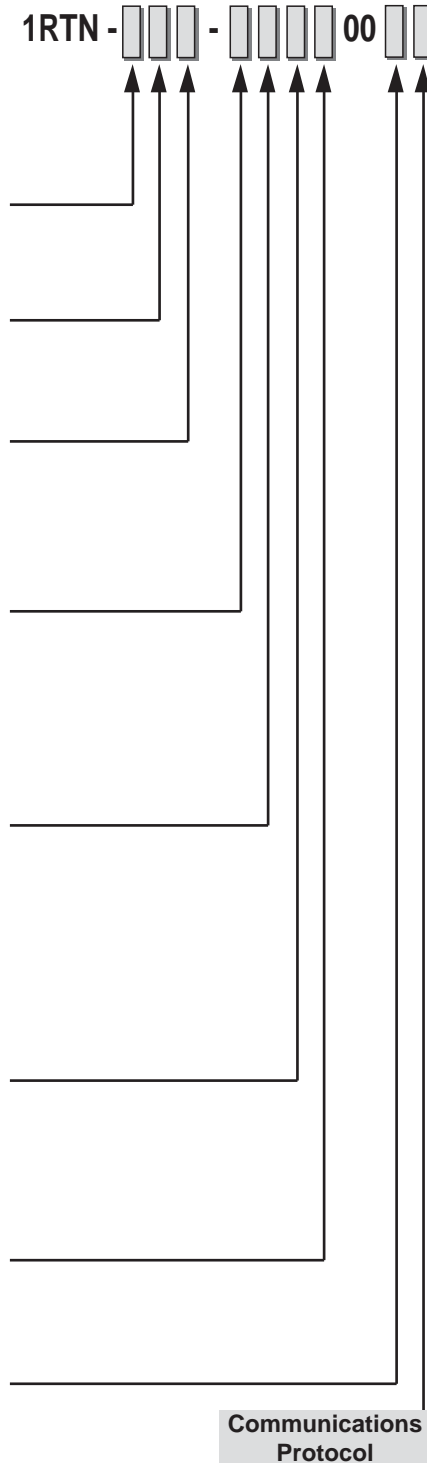
Target	90 - 110 %
Current Compensation	
Enable	Yes / No
Current Compensation Value	1.0 - 10 %
Reactive Compensation	
Enable	Yes / No
Reactive Compensation Value	1.0 - 5.0 %
Maximum Compensation	0.1 - 15 %
Blocking Limits	
Undervoltage Blocking	0.1 - 80.0 %
Max. Switching I	0.1 - 120.0 %
Voltage Bands	
Upper Limit 3	0.1 - 120.0 %
Upper Limit 2	0.1 - 119.0 %
Upper Limit 1	0.1 - 118.0 %
Lower Limit 1	0.1 - 100.0 %
Lower Limit 2	0.1 - 99.0 %
Lower Limit 3	0.1 - 98.0 %
Regulator Control	
Fast Backlash Voltage	100 - 120.0 %
Admissible Insensitivity Degree	0.4 - 5.0 %
Time Factor	1.0 - 10 s
Control of Operations	
Operation Failure Time	5.0 - 20 s
Max. Time Simultaneity	5.0 - 20 s
Max. Time w/o Tap	5.0 - 20 s



Model Selection

Model selection is determined using the following figure, according to the characteristics required:

Functions		
Voltage regulation + reactive power calculation		C
C + tap changer monitoring		D
D with tap changer position BCD coded		E
Options		
Basic Model		1
Rated Current		
5 A		N
Power Supply	Standard Digital Inputs	
24-48 Vdc (*)	24-48 Vdc	1
110-125 Vdc (*)	24-125 Vdc	2
220-250 Vdc (*)	110-250 Vdc	3
(*) +/- 20%		
Frequency / Rated Voltage / Language		
50 Hz / 110 & 110 \ 3 Vac / Spanish		1
60 Hz / 120 & 120 \ 3 Vac / English		3
50 Hz / 110 & 110 \ 3 Vac / English		B
60 Hz / 120 & 120 \ 3 Vac / Spanish		D
60 Hz / 120 & 120 \ 3 Vac / Portuguese		F
Communications		
RS232 Front + RS232 Rear		1
RS232 Front + Plastic Fiber (1mm) Rear		2
RS232 Front + Glass Fiber (SMA) Rear		3
RS232 Front + Glass Fiber (ST) Rear		4
RS232 Front + Plastic Fiber (double ring)		6
I / O Module		
Standard		0
Enclosure Type		
6U x 1/2 of 19" rack		B
Equipment in 19" rack system		V



Standards and Type Tests

Insulation Test	IEC-255-5
Between Circuits and Ground	2 kV, 50/60 Hz for 1 minute
Between Independent Circuits	2 kV, 50/60 Hz for 1 minute
Impulse Test	IEC-255-5
	5 kV; 1,2/50 μs; 0,5 J

1 MHz Disturbance Test	
IEC-255-22-1 Class III	
Common Mode	2,5 kV
Differential Mode	1,0 kV
Fast Transient Disturbance Test	
IEC-255-22-4 Class IV	
	4 kV ±10%
Radiated Electromagnetic Field Disturbance Test	
IEC-1000-4-3	
Amplitude Modulated	10 V/m
Pulse Modulated	10 V/m
Electrostatic Discharge Test	
IEC-255-22-2 Class III	
	8 kV ±10%

Radio Frequency Emissivity	
EN 55011	

Temperature	IEC-255-6
Operating Range	-10° C to +55° C
Storage Range	-25° C to +70° C
Humidity	95% (non condensing)

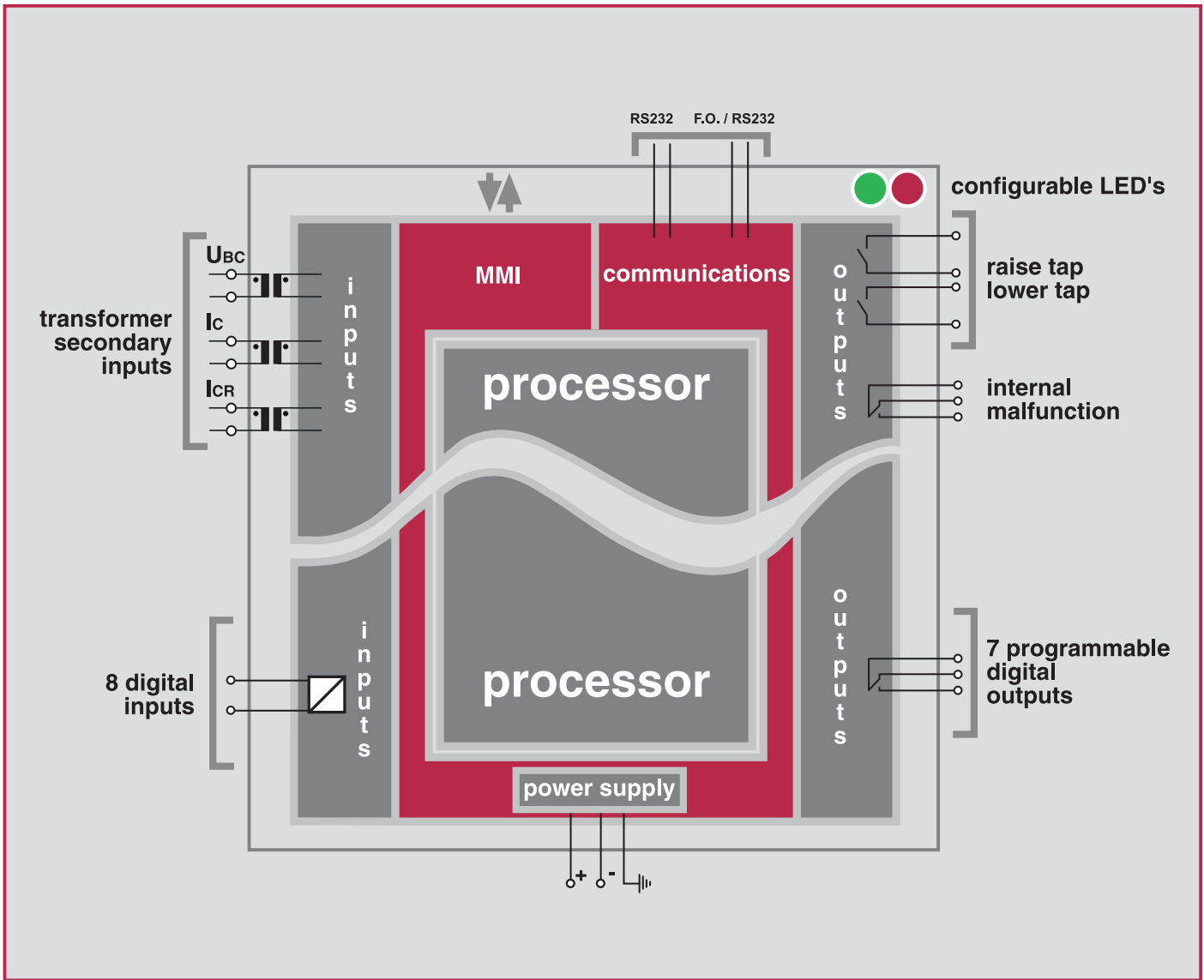
Power Supply Ripple	
IEC-255-11	
	< 20%

Vibration Test (sinusoidal)	IEC 255-21-1 Class I
Shock and Bump Test	IEC 255-21-2 Class I

RTN terminals comply with the EEC 89/336 standard of electromagnetic compatibility



Generic Block Diagram



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