



STATVAR LINE - VED905 V5L SYNCHRONOUS MOTOR EXCITER

EXCITATION SYSTEM FOR SYNCHRONOUS MOTORS



MANUAL

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Note: The VED905 V5L relay leaves the factory with 3 selectable languages, English, Portuguese and Spanish, and can also be supplied with other languages, upon request.

VED905 V5L

SYNCHRONOUS MOTOR EXCITER SYSTEM



The VED905 V5L Static Exciter / Power Factor Regulator is the newest model in Varixx's advanced family of exciters for Synchronous Motors. The VED905 is a Digital Regulator with a touch screen, which, together with the specific Power Module, composes a Static Exciter for excitation currents between 1 and 2000 Amperes, which can operate fully automatically.

The VED905 V5L can be programmed via keyboard or Modbus network or by Ethernet.

The VED905 has dozens of built-in protections and functions, all programmable.

Dozens of variable and status readouts are available on the liquid crystal display and via Modbus.

Faults are memorized, with date and time of occurrence.

The last event or first fault that occurred is also memorized, as well as various data, such as the time of the last excitation, number of hours excited, number of total hours, etc.

Several intelligent functions facilitate application, such as switching without disturbances (Bounceless) between "Automatic" and "Manual Open Loop" or "Manual Constant Field Current" or even between different modes of "Settings". Other functions available, such as "PID Auto-tune", Calibration of readings, Fault Indication, Active Operating Modes and others facilitate application and operation.

Several types of operation point setting are available individually or in combination, such as "Up/Down", "Keyboard" (Touch Screen), Potentiometer, 0 to 5 VDC, 0 to 20 mA or Modbus network.

The VED905 V5L features great response time (10 mS) with built-in Power Factor Sensing and low first-order delay.

The VED905 V5L can work in several modes such as: Constant Field Current, Constant Power Factor or Constant KVAR or Constant Field Current with "Droop" by Power Factor or by KVAR (allowing to work in "tandem" configuration, with more than a motor on the same shaft).

One of the main characteristics of the VED905 V5L is the automatic dual-channel system with dual setpoint of work point and dual PID (Primary and Secondary) in addition to the manual channel, which allows switching to "Constant Field Current" mode that can be used in start-up and synchronization, for "Constant Power Factor" without the need for intervention at the work point, being able to work completely without operator supervision.

It has programmable automatic limitation functions of Leading and Delaying Polar Angle and Minimum and Maximum Excitation Current.

It also has a "Pull In Booster" function with a current ramp up to the setpoint, facilitating synchronization with heavy loads.

The semiconductors in the power module are "isolated base module" type allowing for clean and reliable construction.

A specific "Control" input facilitates operation in selectable "Force Open Loop" and "Force Field Current" modes. The digital inputs and outputs can be programmed for different functions.

MAIN ADVANTAGES

DIGITAL CONTROL

WITH ETHERNET

COMPACT AND EASY TO USE

TOUCH SCREEN - FRIENDLY

DIGITAL MEASUREMENTS

EVENT HISTORY

PLOT OF VARIABLES

TWO CONTROL CHANNELS

WITH ETHERNET

APPLICATIONS

- Excitation systems for brushless synchronous motors.
- Excitation systems for slip ring synchronous motors.
- Excitation systems for synchronous motors with external auxiliary rotary exciter.

The **VED905 V5L** relay has Ethernet communication with several protocols, and can be accessed from anywhere by mobile devices or not.

Ethernet protocols:

TCP/IP (Modbus Slave): Modbus over Ethernet).

Ethernet/IP: ODVA CIP over Ethernet.
FTP: (File Server) File Transfer Protocol.

NTP Protocol: Network Time Protocol

HTTP (Web Server): Hypertext Transfer Protocol (Web Server).

TECHNICAL DETAILS

- **Application:** High performance Digital Static Exciter with color touch screen, for Synchronous Motors, with Modbus RTU protocol communication.

- **Channels:** Two channels with independent and switchable PID and setpoint.

- **Control Signals:** “Up/Down”, “Keyboard” or Modbus Network.

- **Modes:** “Automatic”, “Manual Open Loop”, “Manual Field Current”.

- **Regulation:** Constant Power Factor or KVAR, Constant Field Current with or without "Droop" by P.F. or KVAR.

- **Programmable protections** (21 total): Line Over and Under Voltage, Stator Over and Undercurrent, Lead and Lag Polar Angle Trip and Limitation, Minimum and Maximum Field Current Limitation and Trip, Over and Under-power, Long Start, Over-temperature, External Fault, Loss of Field, Delay for restart after hot and cold stop and Loss of Control (Self-monitoring).

- **Additional programmable functions:** Pull In Booster with “Soft Ramp”, Dual automatic channel with independent setpoint (PID1 for Ictc and PID2 for PF cte, Input limit in PF cte, Change from PID1 to PID2 automatic or commanded, “Reset” and Manual/automatic “Mute”, Memory of the 1st fault, fault history, “PID Auto Tune”, “FAR” (Field Application Relay) and “FCX” (Loading) signal inputs and outputs, and others.

- **Signals and Measurements** (31 Total): Line Voltage and Current, KVA, KVAR, Power Factor, KW, Field Current, “Lead” or “Lag”, “Setting Range”, % of Current “Setting”, Limits Active, Active Clamping, “Mode/Droop” Status, “Droop Range”, Operation Mode, Regulation Mode, “Setting Mode”, “Forcing Mode”, Forcing Setting”, Fault Signaling, “Modbus Status”, “Modbus Messages”, Time and Date, Last Event, Last Excitation and De-excitation Time, 1st Fault, Fault and Event History, Excited Hours, Total Hours and Cycles.

- **Programming:** via touch screen or network.

- **Inputs and Outputs:** 4 digital inputs and 4 digital outputs, all programmable.

- **Ethernet communication:** with several available protocols.

VED905 V5L RELAY CHARACTERISTICS

Power Supply	24 VDC, 150 mA
Moisture	5 - 95%
Dimensions	96 mm x 125 mm x 31 mm
Connectios	1 x RS232 1 x RS485 1 x CAN (125 Kbps - 1 Mbps) 1 x Ethernet (1-10 Mbps/100 Mbps) 1 x USB Mini Program 1 x USB Flash 1 x Micro SD/SDHC
Inputs	4 analog 0-20 mA (50 ohms) 12 Bits, Error: 1,5% FS Max 4 digital Programmable - 0-24 VDC Min On= 8VDC, Max Off: 3VDC (Starting, FAR, FCX, Up, Down, Force Field Curr, Force Open Loop, Reset, External Fail)
Outputs	4 Programmable outputs, Half-Bribrge 0,5A max, 10 - 30 VDC, C. Source + Protections: Short-circuit / Over Voltage. (PWM - Firing, Start Permission, FAR, FCX, Alarm, Trip, Opman)
Communication	Modbus RTU, CsCAN Ethernet, Devicenet (Optional)
Screen	Color, WVGA (480 x 272) Colors 64K Touch Screen Resistive 4,3" 450 cd/m ²
Certificates	CE / FCC Compliance - Part 15 of FCC
Connectors	3,5 mm - pluggable
Weight	270 Grams
Temperature	Operation: -10 °C - 60 °C Stored: -30 °C - 70 °C
RTC battery (only for the Real Time Clock)	Operation: > 10 Anos Stored: 5 - 10 anos Clock error: 8 s / mês at 25 °C max

MAIN BENEFITS

- **Color Touch Screen.**
- **Ethernet Communication**
- **Operates in 3 programmable modes.**
- **Several built-in protections.**
- **Real-time graphical recording (Plot).**
- **Failure and event history.**
- **Continuous readings.**
- **Built-in Modbus RTU serial communication (other protocols on request).**
- **Two independent PID control channels.**
- **Built-in Autotune function**

• System Components:

System: VED905 V5L/xxxA/yyyV/m/n/p/r/zzz

Control module: VED905 V5LC.

Power Module: VED905 V5LP/xxxA/yyyV/m/n/p/r/zzz.

• Rated Currents: 25 to 2000 Amp.

• **Power Control:** Compact, fully controlled, three-phase thyristor bridge or PWM from 1000 Hz to 16000 Hz, with IGBT.

• **Isolation:** 1200 VDC (between Command/Power and between Power and Mass).

• **Power Control Type:** Phase angle with thyristors or PWM with IGBT.

• **Response Time:** Maximum 10mS.

• **Control loop:** Fully programmable Independent PID type - "Bias", P (Proportional gain), I (Integral), D (Derivative), "Derivative Term" (Error=PV-SP or PV=Process Value), "Dead Band" (Lower and Upper), "Slew Time" and others.

• **"Droop" / "Compound" Adjustment Range:** 0 to 10% / 10 to 100%.

• **Operation Modes:** I field cte, I field cte with droop, Power Factor cte, KVAR cte (with dual channel for independent adjustment of F.P. or KVAR).

• **Operation Point Setting:** "Up/Down", "Keyboard", "Up/Down" + "Keyboard".

• **Digital Outputs:** 04 Programmable for "Starting Permission", "FAR Output", "FCX Output", "Alarm" or "Trip".

• **Pull In Booster:** with ramp to setpoint.

• **Adjustment Scales:** +/- 20% and +/- 120%.

• **Initial Setting:** Programmable for "Last Value", 0%, 50%, 100% and "Nominal".

• **Operation Modes:** "Automatic", "Manual Field Current", "Manual Open Loop".

• **Switching between Operating Modes:** "Bounceless" type, without disturbance.

• **Switching between Setting Modes:** "Bounceless" type, without disturbance.

• **Programming of parameters and values:** "On line".

• **Reading Values:** Line Voltage, Line Current, Power (KW), Apparent Power (KVA), Reactive Power (KVAR), Power Factor, Field Current.

• **Programmable limits:** Leading Polar Angle, Lagging Polar Angle, Minimum Excitation Current, Maximum Excitation Current and P.F. cte.

• **Power Factor Reading:** By built-in internal transducer or optional external transducer.

• **Manual to Automatic Transfer Modes:** Programmable for "Maintain Process Value", "Setting = 0%", "Setting = 50%", "Setting = 100%", "Setting = Nominal".

• **Analog I/O Filters:** Programmable.

• **Calibration of Readings:** Zero and Scale, all independent and fully digital and can be performed "On Line".

• **Calibration of Scale, TP, TC and Nominal Values:** All digital and "On line".

• **Autotune Function:** Available, to facilitate and optimize PID calibration.

• **Communication:** Serial RS232C MODBUS RTU protocol (optional ASCII) for "Point to Point" connection or with external RS232C/RS485 converter, for network use. (Droop Out). CAN port with optional CsCAN or Devicenet protocol.

• **Protections:** Overvoltage, Undervoltage, Leading Polar Angle, Lagging Polar Angle, Field Undercurrent, Field Overcurrent, Field Overtemperature, Field Loss, Line Overcurrent, Line Undercurrent, Overload, Underpower, Long Start, Overtemperature, External Fault, Loss of Control (Self-monitoring) and (Delay for restart - Cooling.)

• **Actions on faults:** Independently programmable for each fault in "None", "Alarm", "Inhibition", "Trip" and "Both (Trip + Inhibition)", "Force Field Current" and "Force Open Loop".

• **Delays for fault detection: Programmable.**

• **Real Time Clock: Included.**

• **Programming:** With user-changeable password.

• **Forcing:** Operating Mode and Setting Mode with programmable password.

• **Operating mode in Power Factor cte or KVAR cte:** "Compound" from 10 to 100% to optimize stability.

• **Fault History:** with Date and Time.

• **Memorization of Events:** 1st Failure, Last Event with time and date, Time and Date of the last start and Time and Date of the last stop, Total running hours, Total energized hours and Number of starts.

• **Programmable outputs:** static type for activating relay terminals (Starting permission, FAR, FCX, Alarm and Trip)

• **Active Screens:** 100+ multiple screens.

• **Repeatability and Uniformity of adjustment:** 100% (Free of analog adjustments - no "Trimpot" used externally or internally).

• **Up/Down adjustment resolution:** 0.01%.

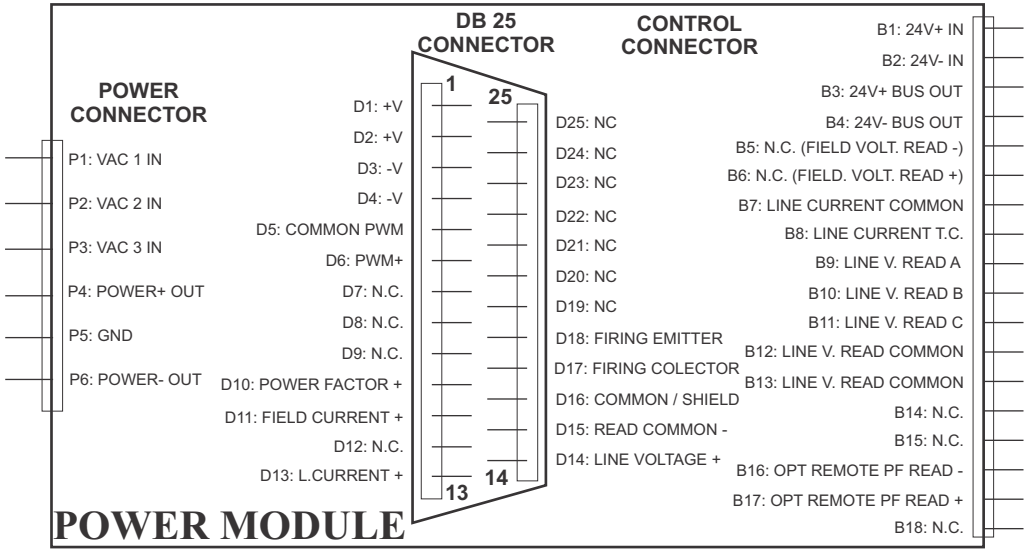
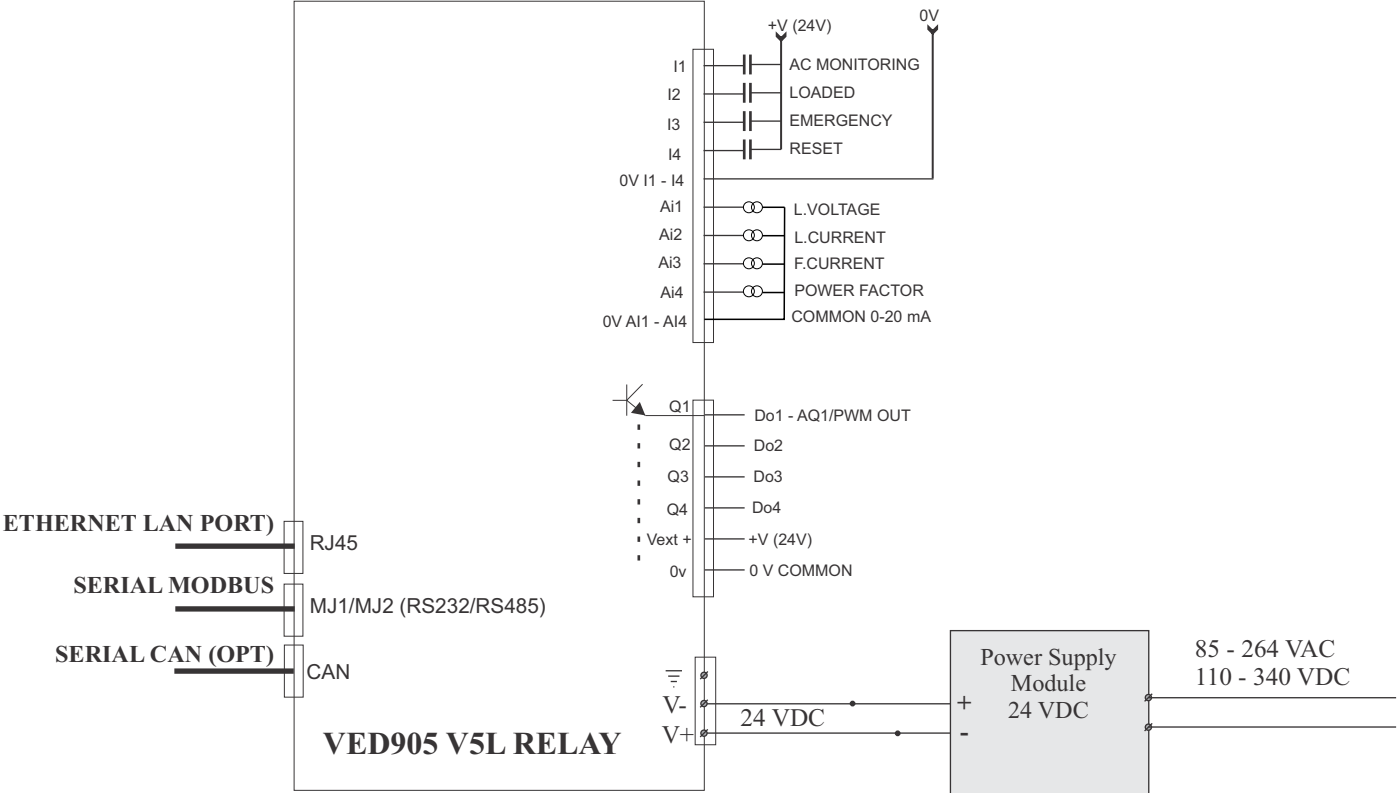
• **Up/Down Adjustment Speed:** 3 speeds automatically selected every 2 seconds that the keys are kept pressed.

• **Programmable inputs:** Starting, UP, Down, FAR, FCX, Reset, Force Open Loop, Force Field Current.

CONNECTIONS

VED905 V5L

NOTE: The system is supplied with the cabling ready between the controller and the power part (DB25). The user simply needs to connect the field connections according to the diagram provided on a case-by-case basis.



TYPICAL INTERCONNECTION

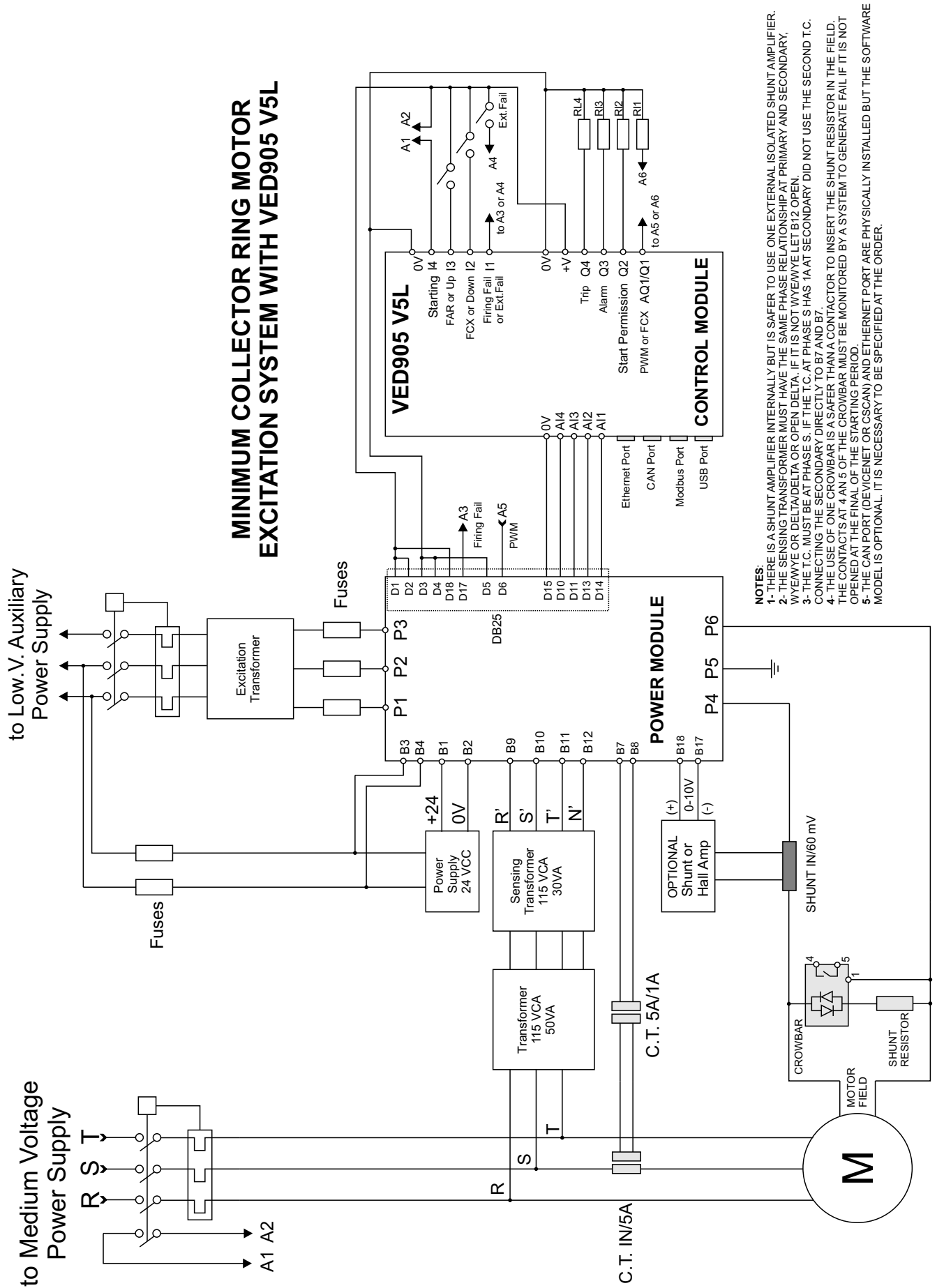
- In the case of a power module with thyristors, the correct phasing of both the excitation transformer and the read and synchronism transformer is important. In the field, during the Startup, it is necessary to check the synchronism and correct triggering of the phases in the thyristors. This is not necessary if the power system uses IGBT.
 - The Excitation Transformer must be Delta/Delta or Delta/Star with adequate voltage and power to obtain the Ceiling Voltage (“Ceiling Voltage” = $V_{sec} \times 1.3$).
 - Fuses must be ultra-fast types with i^2T 30% lower than the Exciter i^2T (see Data Sheet for each equipment).
 - The Voltage Sensing Transformer (30 VA minimum) must be connected to the motor stator terminals. The nominal voltage of the secondary must be 115 VAC, whose voltage is later lowered to 5VAC with a second transformer supplied with the exciter and it cannot have phase rotation, it must be either Star/Star, preferably Delta/Delta or Delta Open, optionally. (see data sheet).
 - The T.C. (Current Transformer) for sensing the Power Factor must be in phase S obligatorily. The T.C. must have a 1A secondary. If a 5A secondary CT is used, a second 5A/1A CT must be used to have the final output at 1A.
 - The use of Crowbar is optional and usual in Slip Ring motors, replacing the shunt resistor application contactor, with several advantages (See bulletin 219 Varixx).
 - The field application contactor is optional since the Exciter has the “FAR” function.
 - The fast de-excitation resistor and its application contactor are optional for brushless motors. The resistor can be equal to or less than $R = R_F \times 10$ and of adequate power to withstand the surge current.
 - Field Current Transducer can be “Shunt” type or “Hall Effect” type. In both cases the relay input signal must be 0 to 5 VDC and isolated from the power system. (See VSA605 bulletin).
 - The Field Voltage Transducer must have a 0 -10 VDC output with power system isolation. The nominal field voltage must correspond to an output voltage of 5VDC on the Transducer (See VRV10 bulletin).
- The digital control inputs have an acceptable voltage range of 15 to 28 VDC (nominal 24 VDC).
- To adjust the working point, just use two buttons (“Up” and “Down”) to increase or decrease or act

on the buttons on the touch screen. This is the best system, as it is fully digital and has the function of starting work at predetermined points, including the last value used.

- Optionally, in the VED905 X5F model used for systems with follow up, a potentiometer or a 0 to 20 mA input can be used.
- If the user wants, he can use an external transducer for Power Factor (Optional, as it is already included internally). VED905 V5L can measure Polar Angle from voltage and current signals. The External Transducer must have a 0 to 10 VDC range. The half scale (5V) must correspond to unity power factor. Levels from 0V to 5V can correspond to Inductive or Capacitive and levels from 5V to 10V can correspond to Capacitive or Inductive according to the polarity programming in the VED905 V5L.
- An externally or internally generated “FCX” signal can be used to command operation in “Secondary channel” (S) with “Droop” or “Compound” after load input to the motor.
- A “FAR” input signal controls field application by the VED905 V5L and a “FAR” (Field Application Relay) output contact, if programmed, can command a field application contactor.
- In the “Startup”, the correct polarity of the CT in phase S or of the External Signal must be verified. If the Power Factor indication is not correct, invert the CT (there must be some load connected to the motor for a stable reading to occur, otherwise the reading of F. of P. should not be considered). With the motor operating in cte field current mode, if the indications are inverted (LEAD / LAG), invert the polarity programming in menu 3.18.
- Crowbar dispenses with the use of a contactor for the application of a shunt resistor, however, if a contactor is used, it must apply the discharge resistance for the entire starting time and remove it after applying it to the field. Using Crowbar is much safer than conventional mechanical contactors.

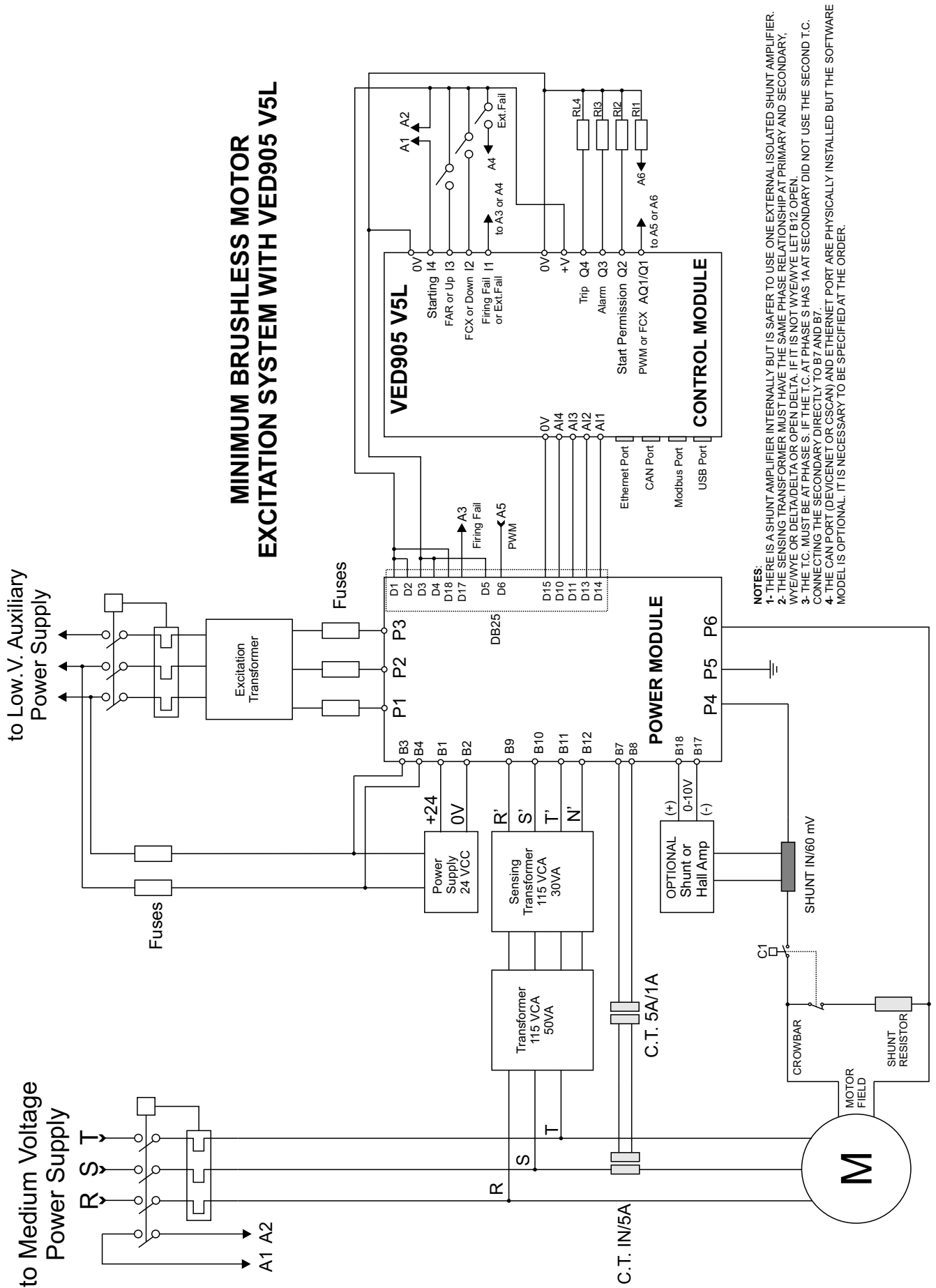
TYPICAL APPLICATION

Minimum System for Slip Ring Motor



TYPICAL APPLICATION

Minimum System for Brushless Motor



NOTES:

- 1- THERE IS A SHUNT AMPLIFIER INTERNALLY BUT IS SAFER TO USE ONE EXTERNAL ISOLATED SHUNT AMPLIFIER.
- 2- THE SENSING TRANSFORMER MUST HAVE THE SAME PHASE RELATIONSHIP AT PRIMARY AND SECONDARY, WYE/WYE OR DELTA/DELTA OR OPEN DELTA. IF IT IS NOT WYE/WYE LET B12 OPEN.
- 3- THE T.C. MUST BE AT PHASE S. IF THE T.C. AT PHASE S HAS 1A AT SECONDARY DID NOT USE THE SECOND T.C. CONNECTING THE SECONDARY DIRECTLY TO B7 AND B7'.
- 4- THE CAN PORT (DEVICENET OR CSCAN) AND ETHERNET PORT ARE PHYSICALLY INSTALLED BUT THE SOFTWARE MODEL IS OPTIONAL. IT IS NECESSARY TO BE SPECIFIED AT THE ORDER.

TYPICAL APPLICATION

Normal Operation Example:

At the start of the start, the “Starting” contact connected to the digital input “Starting” is closed. If the motor is a Slip Ring type, an external Field Application Relay (FAR - Field Application Relay) (See bulletin for VR9045 Varixx or SPM GE-Multilim) can, optionally, command the field application at the best time for synchronization (Pull In). If the motor is a Brushless type, the application can be by speed or time (Delay in menu 3.1) . The VED905 V5L has four programmable outputs, one of which can be programmed for FAR output, optionally controlling a Field Application Contactor. If the motor is Brushless, it may have an internal synchronism controller (Control Box) type M1 or M2, Varixx. In the case of the M2, the field can be applied at the beginning of the match, as the internal Control Box controls the effective application, at the correct speed and polar angle. Setpoint 1, primary (P) can be adjusted for constant field current, close to the field current nominal value (50% of setpoint normally),

keeping PF close to 1. With the internal or external “FCX” command or by load, it passes to setpoint 2, secondary (S), which is normally 50%, keeping the PF constant at 1.

To turn off the motor, simultaneously turn off the stator voltage and the “Starting” contacts, as well as the “FAR” and “FCX” input contacts, if used.

The VED905 V5L has an internal timing that prevents the motor from starting again for the times programmed in menu 3.5 and 3.6 (New Start Cold and New Start Hot). (To use this function one of the output contacts must be programmed for “Starting Permission”.

NOTES:

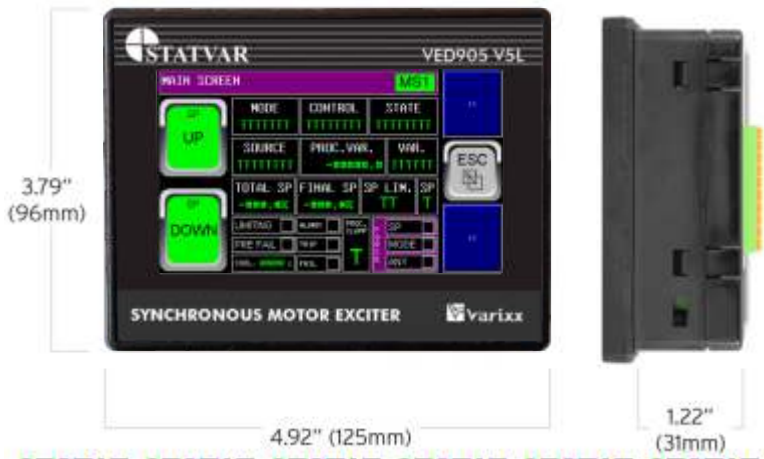
1 - The diagrams are a simplified version and do not show auxiliary devices such as external protection relays etc. The actual schematic must be drawn up by the application engineer.

2 - It is advisable that analog signal connections are made with shielded cables with the shield connected to the ground terminal.

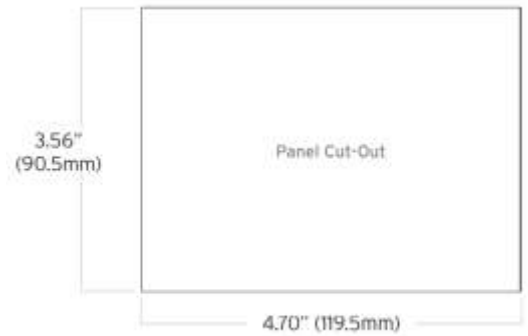
MECHANICS



- 1- POWER 24 VCC
- 2- D.I. / A.I. CONNECTOR
- 3- D.O. / AQO. CONNECTOR
- 4- CAN PORT
- 5- RS232/RS485 SERIAL PORTS
- 6- CONFIGURATION SWITCHS
- 7- ETHERNET LAN PORT
- 8- MICRO SD SLOT
- 9- USB PORT



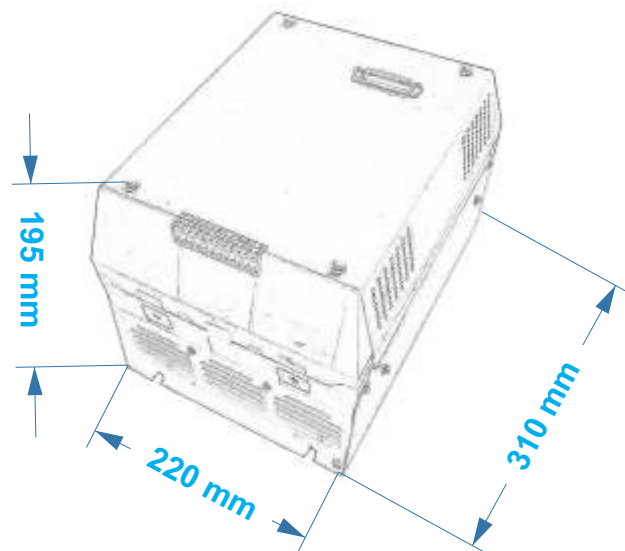
PANEL CUTTING



DIP Switchs in the Relay

DIP SWITCHES			
PIN	NAME	FUNCTION	DEFAULT
1	RS-485 Termination	ON = Terminated	OFF
2	CAN Termination	ON = Terminated	OFF
3	Bootload	Always Off	OFF

25 A Converter Mechanics (Available up to 1200 A)



TECHNICAL CHARACTERISTICS

VED905 V5L RELAY CHARACTERISTICS

Power Supply	24 VDC, 150 mA
Moisture	5 - 95%
Dimensions	96 mm x 125 mm x 31 mm
Connectios	1 x RS232 1 x RS485 1 x CAN (125 Kbps - 1 Mbps) 1 x Ethernet (1-10 Mbps/100 Mbps) 1 x USB Mini Program 1 x USB Flash 1 x Micro SD/SDHC
Inputs	4 analog 0-20 mA (50 ohms) 12 Bits, Error: 1,5% FS Max 4 digital Programmable - 0-24 VDC Min On= 8VDC. Max Off: 3VDC (Starting, FAR, FCX, Up, Down, Force Field Curr, Force Open Loop, Reset, External Fail)
Outputs	4 Programmable outputs, Half-Bridge 0,5A max, 10 - 30 VDC, C. Source + Protections: Short-circuit / Over Voltage. (PWM - Firing, Start Permission, FAR, FCX, Alarm, Trip, Opman)
Communication	Modbus RTU, CsCAN Ethernet, Devicenet (Optional)
Screen	Color, WVGA (480 x 272) Colors 64K Touch Screen Resistive 4,3" 450 cd/m ²
Certificates	CE / FCC Compliance - Part 15 of FCC
Connectors	3,5 mm - pluggable
Weight	270 Grams
Temperature	Operation: -10 °C - 60 °C Stored: -30 °C - 70 °C
RTC battery (only for the Real Time Clock)	Operation: > 10 Anos Stored:: 5 - 10 anos Clock error: 8 s / mês at 25 °C max

- **Operating Ambient Temperature:** 0 to 45°C.
- **Ambient storage temperature:** -40 to 85°C.
- **Relative Humidity:** 5 to 95% N.C.
- **NEMA Rating:** NEMA 4X.
- **Relay Weight:** 270 Grams.
- **Dimensions:** 125 x 96 x 31 mm.
- **Noise Immunity (EMC Immunity):** EN61000-4-2 / EN61000-4-4 / EN61000-4-5 / EN61000-4-12 / ENV50140/50141
- **Emissions:** EN50081-2 / EN55022 / CISPR11. Class A.

MODULO DE POTÊNCIA 25A COM IGBT

POWER OUTPUT	
Output Type	Filtered PWM
PM Frequency	1/2/4/8/16 khz
Power Converter Type	Buck Converter
Max. Output Voltage	1.35 x VAC Input / 250 VCC max
Max. Output Current	25 A Continuous
Load Type	Machine Field (inductive)
Min. Output Voltage	0 V DC
Max. Output Ripple	5%
Galvanic Isolation	Yes provided by the power transformer)
Final Response Time	10 mS max
BUCK Active switch component	IGBT
Protections at Power Converter	IGBT Monitoring

MODULO DE POTÊNCIA 25A a 1200 A COM TIRISTORES

POWER OUTPUT	
Output Type	Phase Angle Pulse
PM Frequency	120 Hz
Power Converter Type	Full Bridge w/ Thiristors
Max. Output Voltage	1.35 x VAC Input / 600 VCC max
Max. Output Current	25 A a 1200 A Continuous
Load Type	Machine Field (inductive)
Min. Output Voltage	0 V DC
Max. Output Ripple	4,2% at 100% Output
Galvanic Isolation	Yes provided by the power transformer)
Final Response Time	16 mS max
Active Switch Component	Thyristors
Protections at Power Converter	None

CAN NETWORK:

- 1: V+
- 2: CAN H
- 3: SHIELD
- 4: CAN L
- 5: V-

CAN POWER RANGE:

12 - 25 VDC / 75 mA MÁXIMUM.

BASIC COMPONENTS OF THE SYSTEM

Controller Module



Cable Connection Example



Power module



Interconnection Cable



TECHNICAL SPECIFICATIONS

POWER SUPPLY

Signal Pin	Description
V+	Input power supply voltage
V-	Input power supply ground
Gnd	Frame Ground

GENERAL CHARACTERISTICS

- ! Graphical LCD Touch Screen w/ Backlight.
- ! 24 VDC
- ! RS-232 / RS-485 Serial Ports.
- ! Integrated Bezel.
- ! Real-Time Clock.
- ! Flash Memory for easy field upgrades.
- ! Ethernet

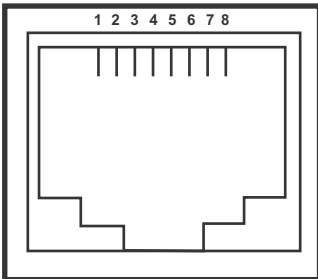
CAN or CsCAN (OPT)

Peer-to-peer network. CAN-based network hardware is used in the controllers because of CAN's automatic error detection, ease of configuration, low-cost of design and implementation and ability to operate in harsh environments. Networking abilities are built-in to the control Module and require no external or additional modules.

CAN Network Baudrate vs. Total Cable Length

Network Data Rate Maximum	Total Cable Length
1Mbit / sec.	40m (131 feet)
500Kbit / sec.	100m (328 feet)
250Kbit / sec.	200m (656 feet)
125Kbit / sec.	500m (1,640 feet)

Mj1/ MJ2 PORT MODULAR JACK



MJ 1 PORT

PIN	SIGNAL
1	-
2	-
3	CTS
4	RTS
5	+5 V
6	0 V
7	RXD
8	TXD

Output Power Supply Max 150 mA

Characteristics

Display Type (LCD Touch Screen):	64K Color Touch Screen
Display Size:	4,3"
Display Screen:	480 x 272 pixels
Touch Screen Type:	Resistive
Number of Colors:	64K
Power Current:	150mA @ 24VDC
Inrush Current:	(20A @ 24VDC) for 1ms.
Height:	96.0 mm)
Width:	125 mm)
Mounting Depth:	31 mm)
Weight	270 g)
Keypad Material:	Lexan HP92 by GE Plastics.
Protocols supported Serial Ports:	CsCAN, Modbus Master, Modbus Slave, and ASCII
Read and Write	
CAN Ports:	CsCAN (up to 253 drops)
Serial Ports:	2: RS-232 / RS-485 Ports.
Network Ports:	1: CAN (CsCAN peer)
Temperature & Humidity:	10 - 60°C,
5 to 95% Non-condensing	
CE	Compliant

CAN PORT PINS

PIN	SIGNAL	DESCRIPTION
1	V-	POWER -
2	CN_L	SIGNAL -
3	NC	NC
4	CN_H	SIGNAL +
5	V+	POWER +

Note: To optimize CAN network reliability in electrically noisy environments, the CAN power supply needs to be isolated (dedicated) from the primary power. The CAN Shield must be attached to the panel as close to the Relay as possible.

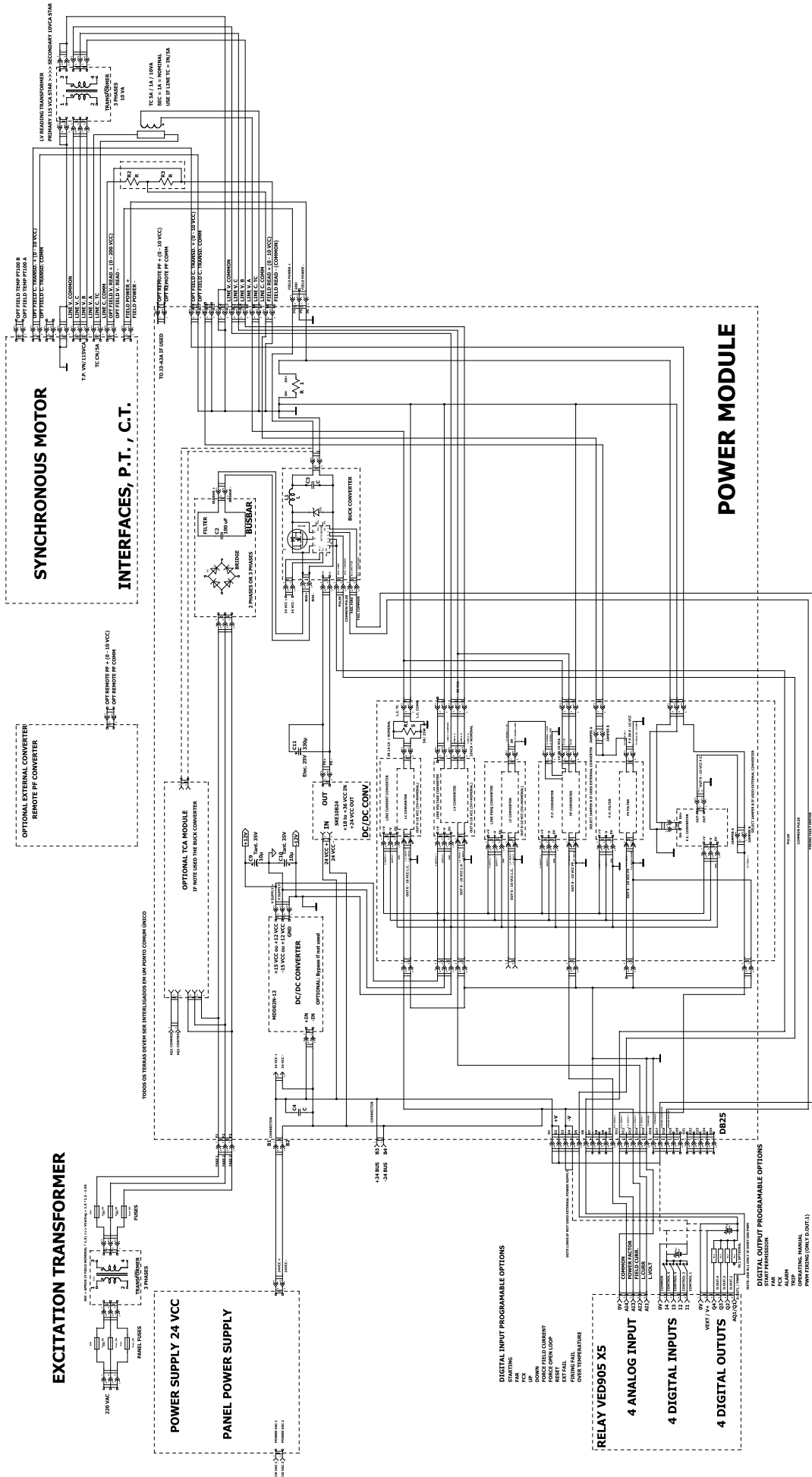
MJ 2 PORT

PIN	SIGNAL
1	RX+/TX+
2	RX-/TX-
3	-
4	-
5	+5 V
6	0 V
7	-
8	-

Output Power Supply Max 150 mA

BLOCK DIAGRAM

VED905 V5L



BLOCK DIAGRAM VED905 V5L V04

MAIN SCREENS FOR OPERATION

MAIN MENU, (ESC) INFO SCREENS

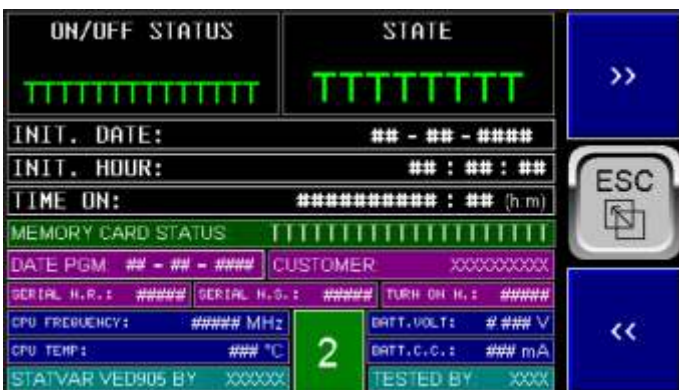


MAIN MENU:

Screen from which all other system screens are accessed. From there, all operating and programming screens can be accessed.

Note that, to eventually call the operator's attention, the «ALARM» field will flash and have a red border to inform that there is an alarm not displayed (Acknowledged) or Cleared (Cleared) on the alarm screen. By touching this field, you enter the alarm screen and you can acknowledge and reset the alarm. More details ahead.

INFORMATION SCREENS



ATTENTION: THE VED905 V5L RELAY LEAVES THE FACTORY WITH A PASSWORD TO ENTER THE PROGRAMMING MENU = «1» CHANGE IT, INSIDE THE MENU «RELAY CONFIG» TO ANY OTHER VALUE (ADVISABLE).



INFO SCREENS 1 to 5:

There are 3 screens paged by the >> and << keys and accessed through the ESC key from the main menu.

INFO SCREEN 1: There is a lot of information. When powering up the system this is the initial screen. Pressing ESC takes you to the main menu above.

VERS: Software version

ETHERNET LINK OK: Indicates that the Ethernet cable is properly connected to the RJ45 LAN port.

ETHERNET NOT LINKED: Flashes if the Ethernet cable is not properly connected and not communicating.

DATE, TIME and DAY OF WEEK: from the internal real time clock.

FAIL: Indicates fault not reset.

ALARM: Indicates Alarm active and Mute has not yet been executed (alarm output active).

TRIP: indicates that a trip has occurred and has not yet been reset (Trip output active).

MAIN SCREENS FOR OPERATION

INFO SCREEN 2: Shows **ON/OFF Status** information that can be: Cooled, Running Cold, Running Hot, Stopped Cold and Stopped Hot. It also shows Actual State information which can be Inhibit, Standby, Starting, Booster, Fail, Alarm, Excited, Loaded and Blocked.

It shows date and time information of the start of operation, total system operation time, relay and software serial number, number of times the relay has been turned on and finally it also shows some hardware information.

INFO SCREEN 3: Mute Alarm and Reset Fail buttons.

If the alarm is active, the Mute button silences it (turns off the Alarm Output).

Being in the Mute condition (Mute already executed) the Reset button clears the fault and turns off the Trip Output.

Actual State: which can be Inhibit, Standby, Starting, Booster, Fail, Alarm, Excited, Loaded and Blocked.

Fail Active: Indicates that there is an active fault.

FAIL: Indicates fault not reset.

ALRM: Indicates Alarm active and Mute has not yet been executed (alarm output active).

TRIP: indicates that a trip has occurred and has not yet been reset (Trip output active).

INFO SCREEN 4: «Fail Safe» system information such as Autoload Enabled, Autorun Enabled, Flash Backup Done (these 3 fields must be active, in green color for the «Fail Safe» system to operate correctly in case of need. Flash Backup Cleared: It will indicate in yellow if there is no Backup file in the Flash memory To create a backup file enter the programming menu and create it after having all the parameters programmed and with the relay operating correctly.

Auto Restore Done, Indicates if there was an automatic restoration of the software and Autoload Fail indicates if there was a restoration failure.

INFO SCREEN 5:

On this screen, you can command the write and read protection on the memory card for safe removal and insertion of the card, with the relay in operation, preventing it from being manipulated during writing operations that could corrupt it.

Remove/Insert: This button is invisible if the relay is in a writing or reading operation so that the Remove/Insert command is not inserted at the wrong time.

Wait: If active, it indicates that the relay is in writing or reading operation.

No Card: Stays active if the relay has no memory card inserted.

Card OK: Indicates that the card is inserted and operating properly.

Ready to Remove/Insert: After the Remove/Insert command chosen in the «Yes» option, this indication becomes active, indicating that the card can now be removed or inserted.

Memory Card: Status: May show one of the following phrases depending on the current system condition:

- 1- Card OK - Operational
- 2- Unknown Format
- 3- No card in slot
- 4- Card Not Supported
- 5- Illegal Swapped
- 6- Unknown Error
- 7- Access Protected

After the Insert/Remove command chosen in «Yes» the sentence will be 6- Access Protected.

Attention: Removing the card without the Insert/Remove command, inserts the Alarm condition in the alarm and history screen if the action for this fault is selected for «Log» in the programming menu. If the action is set to «None» this alarm will not be logged.

If the card is removed after the Insert/Remove command, the alarm will not be triggered even if programmed to «Log»

MAIN SCREENS FOR OPERATION



MAIN SCREEN MS1: Shows 20 fields:

MODE: Shows the regulation mode: Automatic, Man.Fld.Cur. or Man.Open Loop.

CONTROL: Displays the current variable or control mode: FLD AMP, PWR FACTOR, KVAR or MVAR, FLD AMP/PF, FLD AMP/VAR, OPEN LOOP, BLOCK TM, FORCE FLD.

STATE: Shows the state at the moment: STANDBY, STARTING, BOOSTER, FAIL, ALARM, EXCITED, LOADED, BLOCKED.

SOURCE: Shows the control source of the setpoints: UP/DOWN, KEYBOARD, U/D+KBD.

SEARCH VAR.: Shows the value of the variable being controlled.

VAR.: Shows the dimension or condition of the variable being controlled: LAG, LEAD, FORCED, A, FC, PF.

TOTAL SP: Shows the commanded setpoint value between 0 and 100%

FINAL SP: Shows the values of the actual setpoint after eventual 'forcing' or 'limiting', automatic from the system.

SP LIM: Shows if the setpoint is suffering automatic limitation to avoid operator error: NO, < , >. NO for no limitation, < for limiting lower value and > for limiting upper value.

SP: Shows which PID is currently operating: P or S. P for primary (constant current) and S for secondary (other modes).

LIMITING: Indicates whether any automatic limiting is currently in effect.

PRE FAIL: Indicates if a fault is about to be triggered after the programmed delay.

COOL.: Indicates the time for restarting to avoid overheating in the motor. This time is calculated automatically depending on operating conditions.

ALARM: Indicates active alarm

TRIP: Indicates active trip.

FAIL: Indicates active failure (not cleared on the clear fails screen).

PROC. CLAMP: Indicates if control clamping is taking place by calculations in the process and not by a value manually entered in the clamping program in the programming menu. N, < , >. N normal operation without clamping, < for lower value clamping and > for higher value clamping.

FORCE SP: Indicates that the setpoint value is forcing at the moment.

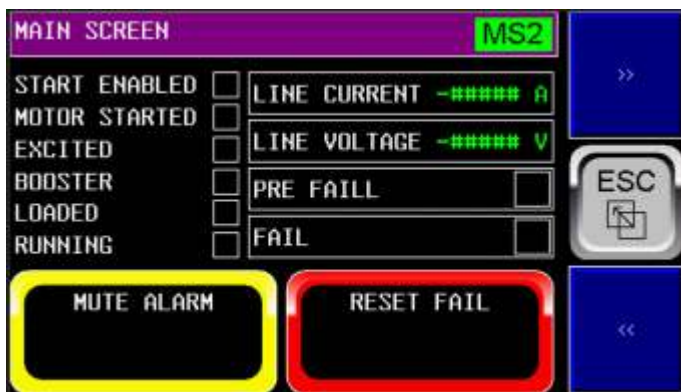
FORCE MODE: Indicates whether there is forcing in 'manual open loop' or 'manual field current' mode at the moment.

FORCE ANY: Indicates if there is any type of forcing at the moment, including Booster.

SP UP: Keyboard setpoint increase button.

SP DOWN: Keyboard setpoint decrease button.

MAIN SCREENS FOR OPERATION



MAIN SCREEN MS2: Show 10 fields:

START ENABLED: (if the engine is already cold enough to restart and there is no active fault at the moment).

MOTOR STARTED: on closing the Starting contact coming from the motor circuit breaker.

EXCITED: Whether the field was applied by the FAR contact and other conditions.

BOOSTER: Whether it is in conditions for Booster application during start-up or load coupling.

LOADED: If the FCX contact and/or the line current is above the programmed value.

RUNNING: If the starting sequence is finished.

LINE CURRENT: Shows the motor line current value.

LINE VOLTAGE: Shows the motor line voltage.

PRE FAIL: Flashes if a fault is about to be detected, before the programmed delay time elapses.

FAIL: if there is an active fault that is not acknowledged and not reset.

MUTE: Alarm silencing button.

RESET: Fault Reset button.

MAIN SCREEN MS4: Show 6 fields

TIME TO NEW START = 'COOL TIME': Indicates the time for a new start and a function of the motor cooling time depending on the operating conditions, starting and stopping.

ON/OFF STATUS: Shows the starting and stopping conditions of the motor according to the programmed cooling time in the programming menu: **Running - Cold** (if it started and the



MAIN SCREEN MS3: It shows 10 fields, 8 of which are measurements and readings, self-explanatory.

PF FORCED: Indicates whether there is currently a 'Force' of 'Power Factor' in order not to exceed a minimum value both in LAG and in LEAD.

COOL TIME: It indicates the time for a new start and the function of the motor cooling time depending on the operating, starting and stopping conditions.



programmed time has passed), **Running - Hot** (if it started and the programmed time has not yet passed) programmed time), **Stopped - Cold** (if stopped while already in the Running - Cold condition and the programmed time has passed) and **Stopped - Hot** (if stopped in the Running - Hot condition and the programmed cooling time has not yet elapsed..

MAIN SCREENS FOR OPERATION



MAIN SCREEN MS5: Show 6 fields

STATUS: Shows operating conditions:

NORMAL: If there is no active fault

ALARM: If the alarm output is active

FAIL: If there is an active fault.

MUTED: If there is an active fault but the alarm has already been muted.

RANGE: shows the programmed range for the setpoints. 20% or 100%

SOURCE: Shows the control source of the setpoints: UP/DOWN, KEYBOARD, U/D+KBD.

MODE: Shows the regulation mode: Automatic, Man.Fld.Cur. or Man.Open Loop.

FORCE SET: Indicates that the setpoint value is forcing at the moment.

FORCE MODE: Indicates that manual forcing is taking place openloop or manual field current at the moment.

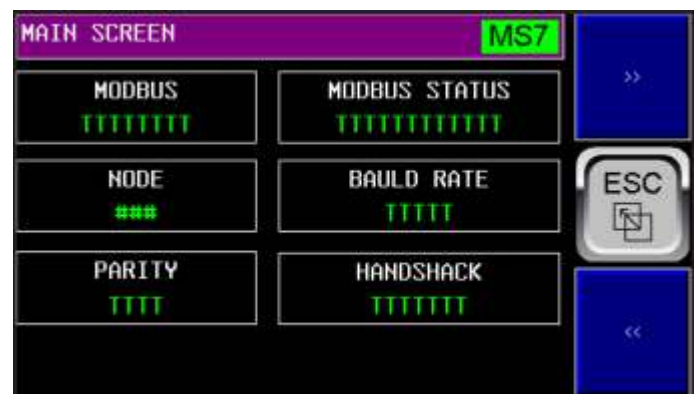


MAIN SCREEN MS6: Shows 9 fields of limiting, forcing and clamping conditions.

FORCED MODE: whether there is a forced mode of 'Manual Open Loop' or 'Manual Field Current'.

FORCED SET: If there is currently a forced setpoint value, calculated internally to protect against operator error.

The other fields are self explanatory.



• **MAIN SCREEN MS7:** Shows 6 fields of Modbus communication parameters, as programmed. It is informational only.



MAIN SCREEN MS8: Shows 7 bargraphs - bars of values from 0 to 100% or 0 to 32000

SP1: Primary Setpoint from 0 to 100%

Process 1: Value of the controlled variable read for actuation by Setpoint P and Primary PID.

SP2: Secondary Setpoint from 0 to 100%

Process 2: Value of the controlled variable read for actuation by Setpoint S and Secondary PID.

PID 1/2 SPF: Final SetPoint value for the PID that is currently active. The final value may be different from the set value due to limitation, forcing and clamping calculated by the system. 0 to 32000

PID 1/2 PVF: Final Process Value for the PID that is currently active. The final value may be different from the value read due to Limiting, Forcing and Clamping calculated by the system. 0 to 32000.

PID 1/2 CVF: Refers to the value of the control output for the power module as a function of the error between SP and PV. 0 to 32000.

This information helps in the startup to establish the best stability of the system.

MAIN SCREENS FOR OPERATION



FAIL / INDICATOR SCREEN FS1: Shows the currently active faults.

There is a **MUTE** button to silence the alarm output and a **RESET** button to reset it.



FAIL / INDICATOR SCREEN FS2: Shows the states of the digital inputs and digital outputs.



EVENT SCREEN ES2:

LAST STOP: Date and time of last stop.

TOTAL RUNNING HOURS: Total number of running hours. It can be reset by the user with the proper password.



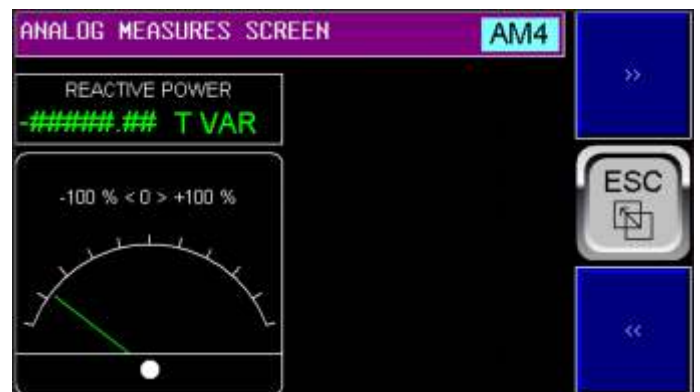
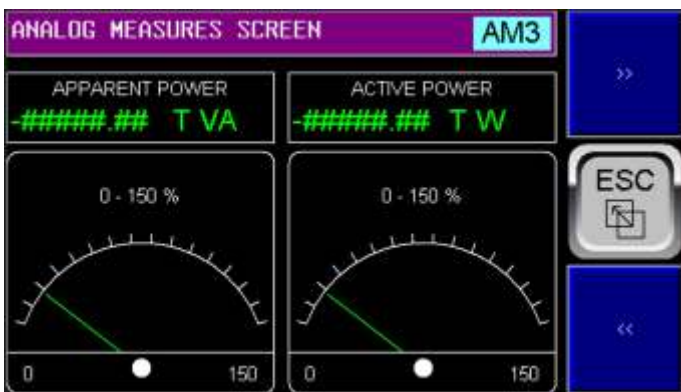
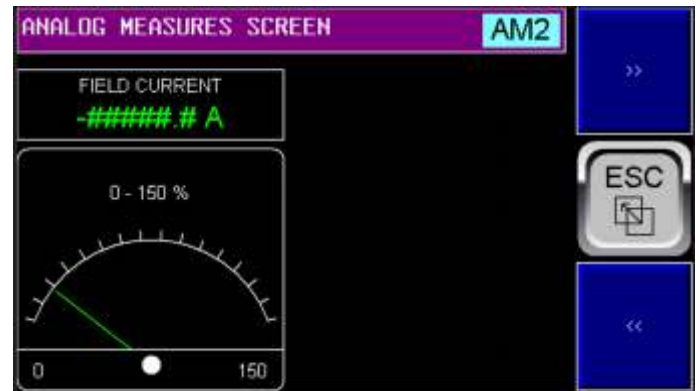
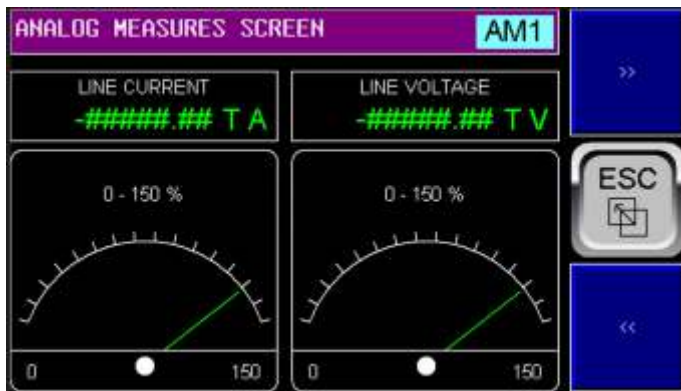
EVENT SCREEN ES1:

LAST EVENT / FIRST FAIL: It shows the last event or first fault: it can be Normal Starting or Normal Stopping or the programmed faults. Shows the date and time of the occurrence.

LAST START: Date and time of the last start

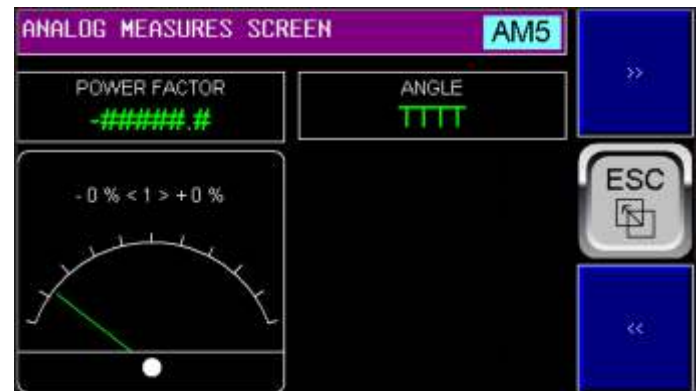
TOTAL STARTING TIMES: Number of total starts. Can be reset by user with password.

MAIN SCREENS FOR OPERATION

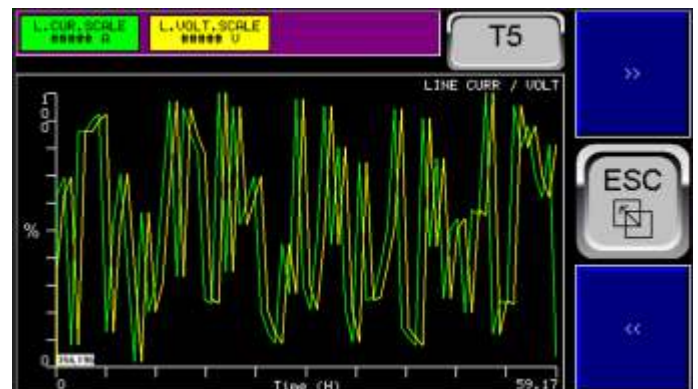
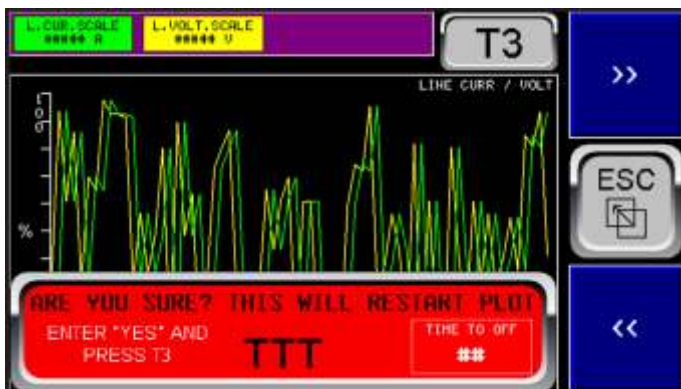
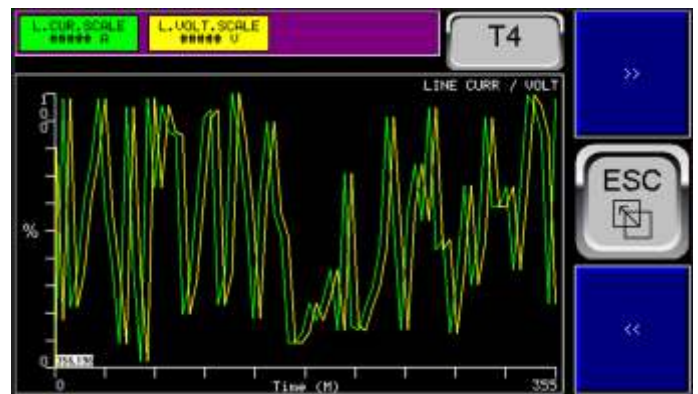
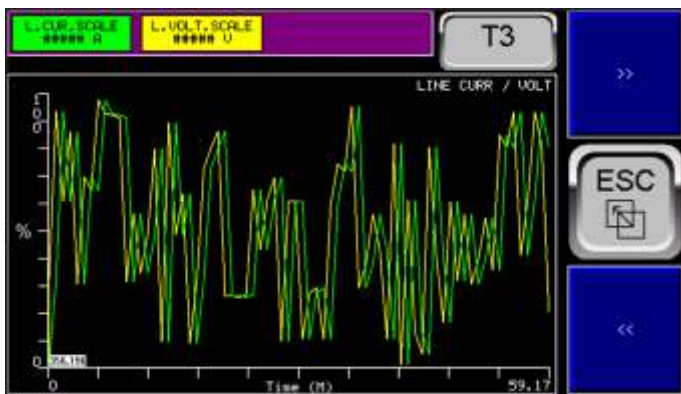
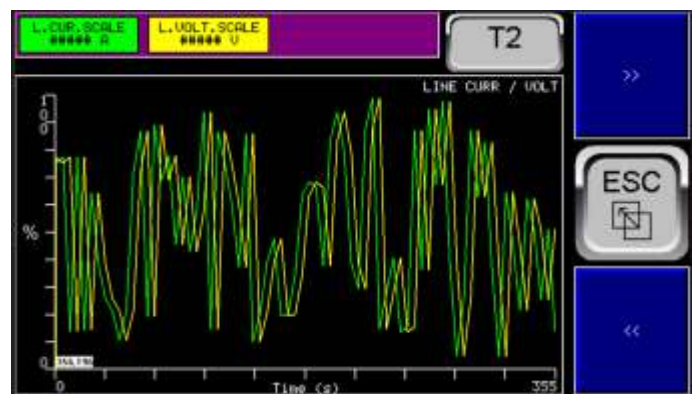
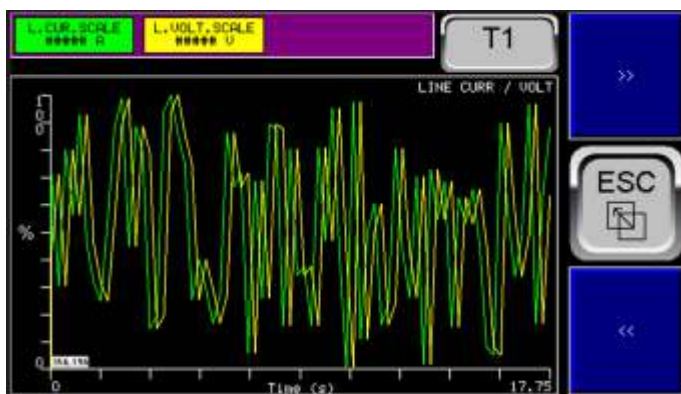


ANALOG MEASURES SCREEN AM1 to AM5:

Shows main readings in analog mode, facilitating interpretation under certain analysis conditions. Scales and variables are indicated on each screen. The digital value is also shown.



MAIN SCREENS FOR OPERATION



TREND SCREEN T1 to T5:

Shows the curves for Line Current and Line Voltage on different timescales (shown on the x-axis). On the Y axis, the scale is always from 0 to 100% of the scale value programmed in the Menu and shown above. For example, if the Line Current scale is 3000 A and the curve is at 50% it means that at this instant the current is 1500 A.

RESET OF CURVES

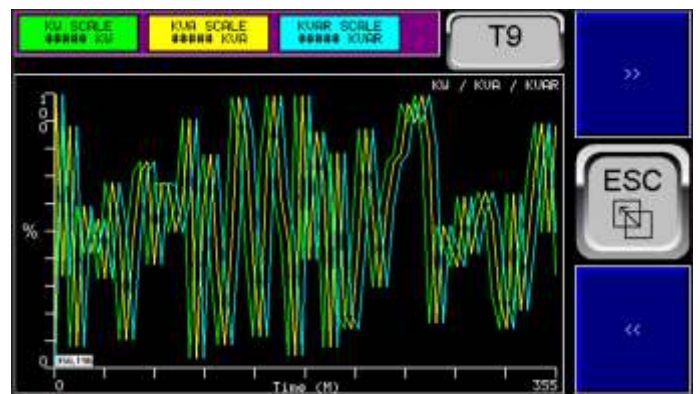
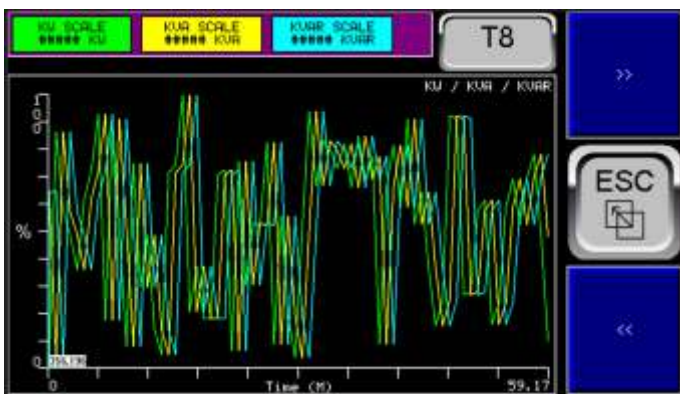
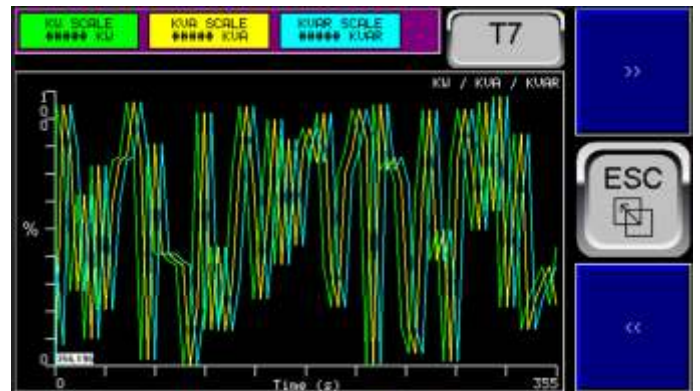
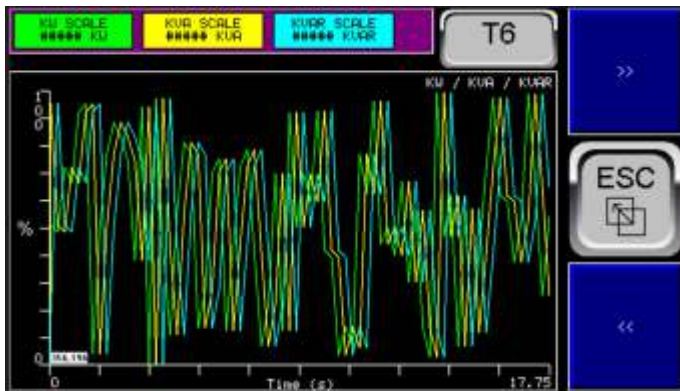
To restart, touch buttons T3 to T16.

When leaving screens T1 and T2 and returning, the curves restart, unlike the curves from T3 to T17.

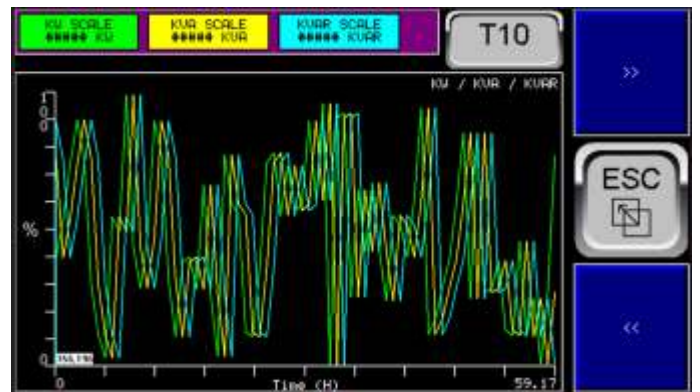
When pressing the T3 to T16 key, a red button appears, asking if you are sure you want to restart the curves on the respective screen. If yes is entered, the operator will have 10 seconds to enter the answer «Yes» into the button and touch T3 to T16 again. Otherwise, the red button disappears and the curves are not reset.

This is intended to prevent inadvertently resetting a curve that has been plotted for a long time, thus losing observable data. See Example T3 Screen above.

MAIN SCREENS FOR OPERATION



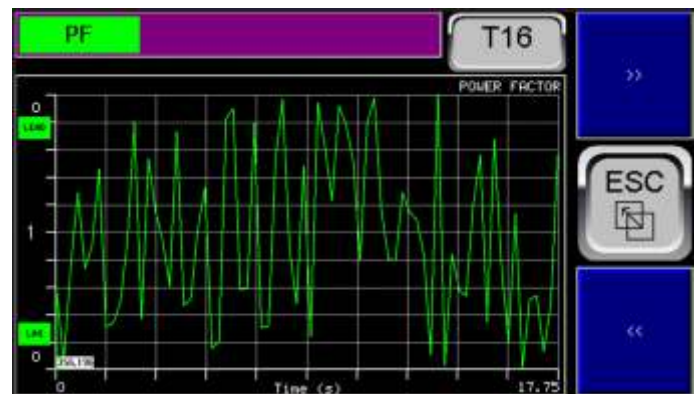
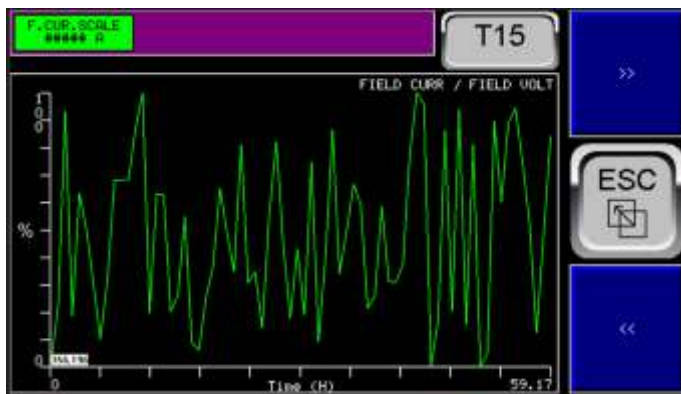
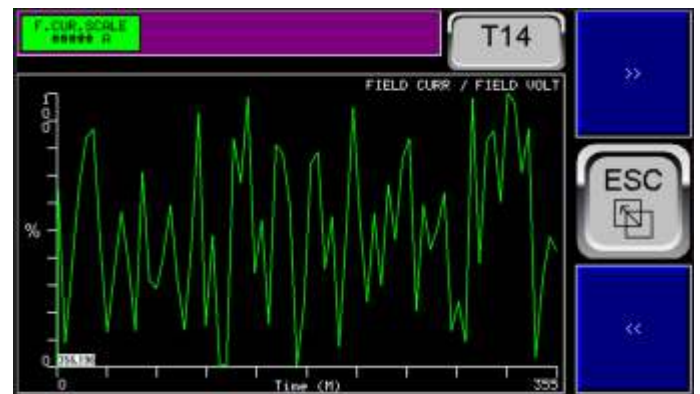
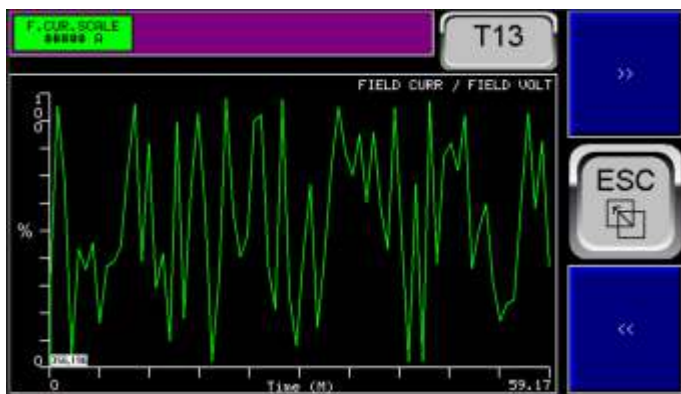
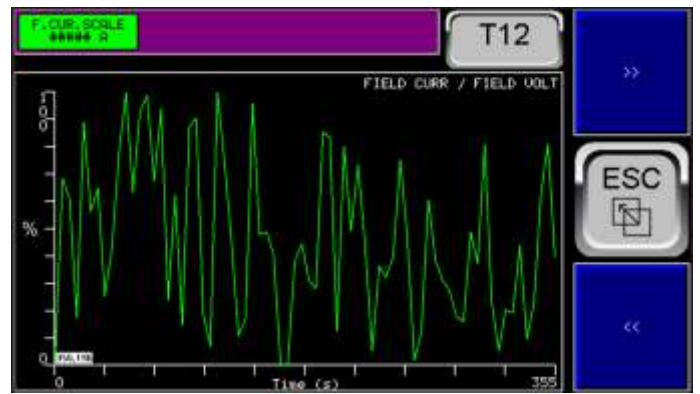
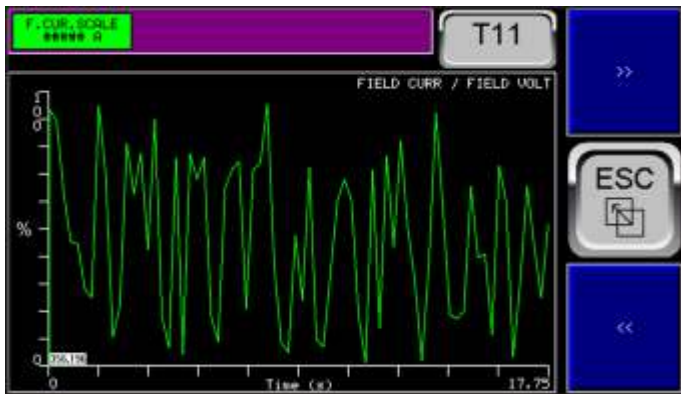
Screens	Sampling Time	Screen Cycle
1, 6 e 11	50 ms	17,75 s
2, 7 e 12	1 s	355 s
3, 8 e 13	10 s	59,17 m
4, 9 e 14	1 m	355 m
5, 10 e 15	10 m	59,17 h
6 e 11	1000 s	5916,67 m
16	50 ms	17,75 s
17	10 s	59,17 m



TREND SCREEN T6 a T10:

Shows the curves for KW, KVA and KVAR on different time scales (shown on the x-axis). On the Y axis, the scale is always from 0 to 100% of the scale value programmed in the Menu and shown above. The same scale explanation of screens 1 to 5 applies.

MAIN SCREENS FOR OPERATION

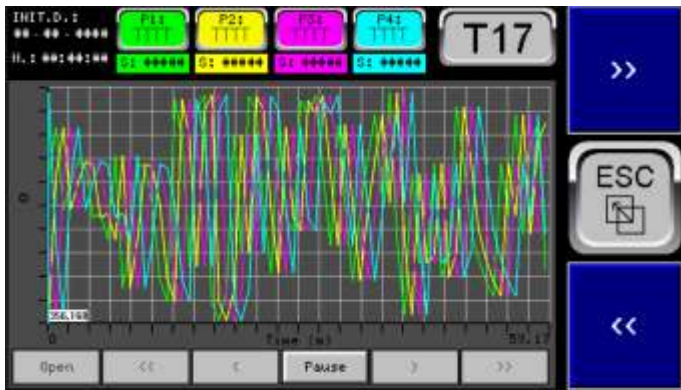
**TREND SCREEN T11 to T15:**

Shows the curves related to FIELD CURRENT on different time scales (shown on the x-axis). On the Y axis, the scale is always from 0 to 100% of the scale value programmed in the Menu and shown above. The same scale explanation of screens 1 to 5 applies.

TREND SCREEN T17:

It shows curves related to POWER FACTOR. On the y axis, the scale goes from 0 LAG to 0 LEAD passing by the value of 1 in the middle of the graph, which is normally the ideal operating point.

MAIN SCREENS FOR OPERATION



TRENDS T17 (Retentive Trending Plot):

It is screen 17 of the 17 screens paged by the >> and << keys.

This resource provides the recording of the curves and data plotted in the same in the memory card of up to 32 Gb inserted in the appropriate slot in the relay.

When initialized in the programming menu, the screen will display in the lower left corner the information in green letters of «**STARTED**» and a file folder will be automatically created on the card with the name Plotvxx where xx is the end of the year in progress. If it is not started, the message will be «**STANDBY**».

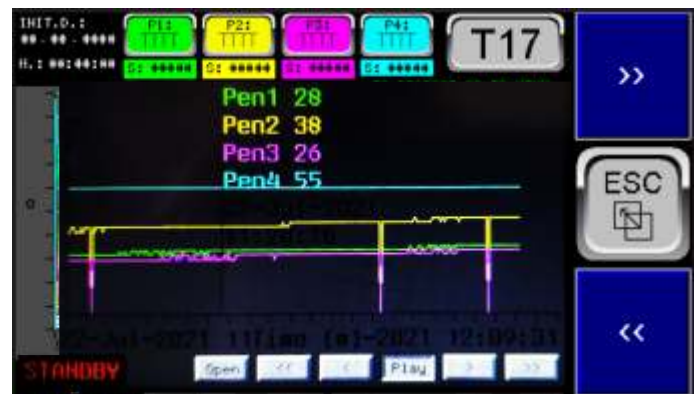
When in «Started», every hour a new file with extension csv will be created, inside this file, with the name composed of the day, month and full hour, without the minutes. Each file contains data separated by commas, which can be opened in Excell using the «Get Data» function within the «Data» tab and graphs can be generated. Each file is automatically saved hourly and will contain 360 readings of each of the 4 variables (4 traces). Each reading is taken every 10 seconds. They are light files of approximately 18 Kb each. Even if you leave the screen, the recordings continue and if the recording is interrupted by switching the relay off and on, a vertical black line appears at this point and the recording continues.

On the screen you can directly insert the plotted variables read and registered, one in each upper button with the colors corresponding to the trace (Line Current, Line Voltage, KW, KVA, KVAR, Field Current).

In the upper left corner, the date and time of the current plot start are shown.

Under each of the 4 variable insertion buttons the corresponding vertical scale is shown.

In the upper right corner is the screen index (T17). This button does not allow the Reset or restart of the curve and if touched it indicates with a sentence to enter the programming menu, turn off and on this resource to restart the curves. This is done to ensure that you do not inadvertently lose memory.



The recorded curves can be replayed on the screen by the relay itself too, to be examined. While they are being re-displayed, the user can pass the finger on the screen and moving the cursor (a vertical black line) being displayed then, for each point, the index of each trace and the corresponding value, with the due colors equal to the dashes beyond the date and time of recording.

At the bottom are the playback control keys. to know. «**Pause**» or «**Play**» If it is showing «**Pause**», the operation is effectively in Play and the curves are being generated and plotted in real time and when pressing it changes to «**Play**» and the operation is effectively in Pause and the curves shown are previously recorded, obtained from the memory card. That is, the button actually shows the state it will enter when pressed.

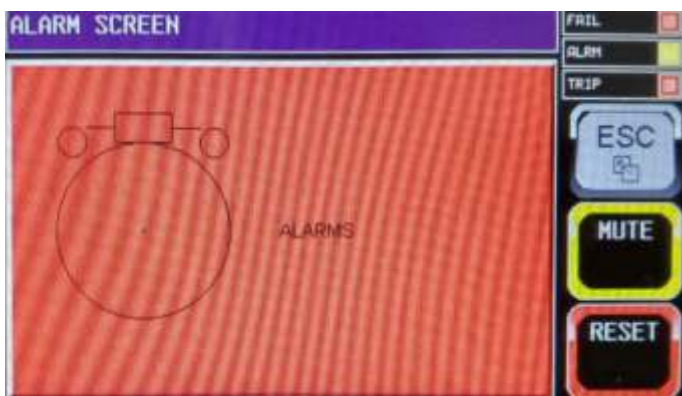
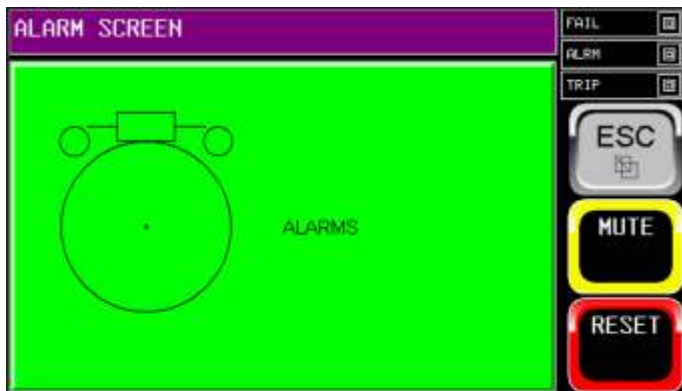
«<<» This button allows you to search for the first curve recorded in the file.

«>>» This button allows you to search for the last curve recorded in the file.

«<» and «>» allow you to search the recorded sequential curves one by one in the sequence.

«**Open**» button that allows selecting a curve to be retrieved, by date and time, by informing in the window that opens the start date and time and end date and time of the period of interest, to restrict the number of curves to be browsed by the search keys above and facilitate its location.

MAIN SCREENS FOR OPERATION

**ALARM SCREEN:**

If it is green when entering, it means that there is no active alarm. If it is red, tap anywhere on the screen and the alarm list will open. The date and time of the occurrence can then be verified and, when Tapping the Ack or Ack All button, each fault or all faults can be recognized respectively. This will change the text color from red to blue and the alarm screen color will change to yellow on exiting with the Esc key while faults are not cleared.

You cannot clear the faults on this screen, only on the Clear screen where you can enter a specific password for this.

HISTORY SCREEN:

There will be the sequence of failures with day and time. When touching any point on the screen it will open to show more details.

Events will be in red. Acknowledged faults on the Alarm screen will be in blue and denials (RTN - Return) of faults will be in green.

Faults with Acknowledge - Ack) (acknowledged) will be in blue.

You cannot clear the faults on this screen, only on the Clear screen where you can enter a specific password for this.

MAIN SCREENS FOR OPERATION



FORCE SCREEN:

Selecting Force from the Main Menu brings up a password screen. This password is independent of the password to enter the programming menu. After entering the correct password, the screen appears with the Force options for the operator.

FORCE MODE: With the options:

RESET FORCE, FORCE MAN. OPEN LOOP, FORCE MAN. FIELD CUR.

The Reset Force option returns to the normal control mode (eg regulating PF) if one of the other forcing options was previously selected.

FORCE SET: With the options:

RESET TO NORMAL AND FORCE KEYBOARD. If the system is programmed to adjust the Setpoint by remote Up, Down and the operator, in front of the panel, feels the need to change the Setpoint to perform a test, for example, he can force and use the buttons on the screen for Up and Down and then then reset to the normal mode established in programming. If Keyboard mode is already included in the programming, this action has no effect.

Force Mode: Allows a temporary change from “Normal” mode, that is, the one programmed in the Menu, to one of the other available modes. For example, you can switch temporarily from “Automatic” mode to “Manual Open Loop” or “Manual Field Current” mode. The “Manual Open Loop” mode sets shooting angles proportional to the “setting” value, without any error correction. In “Manual Field Current” mode, the regulator keeps the set field current constant. In all cases, the choice of scale programmed in the menu (+/-20% or +/- 100%) is valid.

When switching to “Manual Open Loop”, the VED905 forces the “Keyboard” mode and switching is without disturbances (Bounceless). When switching to “Manual Field Current”, the VED905 also sets the best value so that there is no “Bump”. When switching to “Automatic”, there are several available options that can be set in the menu (Maintain PV, 0%, 50%, 100%, Nominal). If the 1st option (“Maintain”) is programmed, the VED905 calculates the setting value to compensate for all relevant parameters and readings (“Droop”, “Readings” and “Setting”) even if during manual mode they have changed and sets the theoretical value to the ideal value. If the normal “Setting” programmed is one of the digital ones, the change will occur without changing the process value. If the normal “Setting” is one of the analogue ones, there will still not be a sharp and fast disturbance since the VED905 promotes a 3 second ramp up to the new value. If the transfer mode is one of the others, there will be a ramp up to the programmed “Setting” value (0%, 50%, 100% or nominal).

These same observations are valid for changing the operating mode within the “Menu” during normal operation, which is perfectly allowed. Always prefer to use digital setting modes. Note that if during the transition the “setting” percentage field is outside the 0 to 100% range, it will be limited to 0 or 100% and the “bumpless” transition will not occur. NOTE: 0-5V or 0-20 mA analogue setpoints only available in the X5F version which is suitable for Follow operation having two exciters in parallel with automatic switching from one to the other in case of failures.

MAIN SCREENS FOR OPERATION

Force Setting: Allows you to temporarily change the setting mode

Current or Normal for “Keyboard” in which you can change the working point using the Up and Down keys to adjust the operating point. The “Force” condition is only valid while the VED905 is energized. At each new power-up, the mode returns to the one programmed in the menu parameters, that is, it returns to the “Normal” mode. The “Force Keyboard” mode is used to make local adjustments in a test case, when there is only remote adjustment of “Setting” in the system. The passage to “Force Keyboard” mode or its return to Normal mode is always done without disturbance (Bounceless) because the VED905 calculates the final setting value to compensate for any changes that may be made in forcing mode.



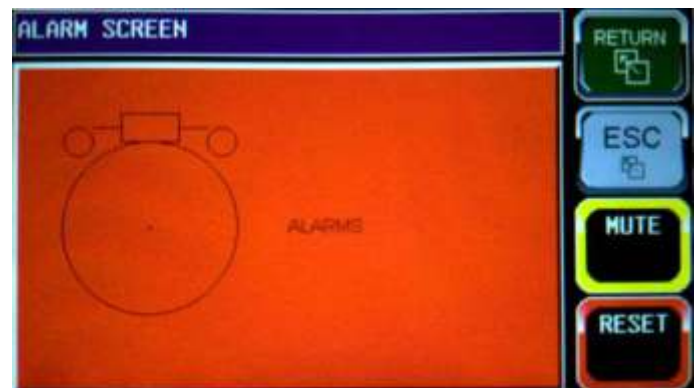
CLEAR ALARM SCREEN:

Selecting **CLEAR** from the Main Menu brings up a password screen. This password is independent of the password to enter the programming menu. After entering the correct password, the screen appears with the options for **CLEAR ALARMS**, **CLEAR HISTORY** and **CLEAR EVENTS**.

Selecting Clear Alarms brings up the Alarms screen.

If it is green when entering, it means that there is no active alarm. If it is red, tap anywhere on the screen and the alarm list will open. On this screen there are the options for Ack (recognition) and Clr (Clear). By touching the Ack or Ack All button, each or all failures can be recognized respectively. This will change the text color from red to blue and the alarm screen color will change to yellow on exiting with the Esc key while faults are not cleared.

On this screen, you can clear (Clear) the faults and the initial screen will return to green.



MAIN SCREENS FOR OPERATION



CLEAR HISTORY SCREEN:

Selecting **CLEAR** from the Main Menu brings up a password screen. This password is independent of the password to enter the programming menu. After entering the correct password, the screen appears with the options for **CLEAR ALARMS**, **CLEAR HISTORY** and **CLEAR EVENTS**.

Selecting Clear History, the Clear History screen appears with the list of events (in red) including the acknowledgment of the same, if carried out on the Alarm screen (in blue) with date and time.

If it is green when entering, it means that there is no active alarm.

Touch the Clear History screen and the second screen will appear with the options of Clr and Clr All to clear each fault or all faults respectively.

MAIN SCREENS FOR OPERATION



MENU:

Selecting MENU from the Main Menu brings up a password screen. This password is independent of the password for forcing and clear. After entering the correct system configuration password, entering parameters, etc., which will be detailed later in this manual.

If the “Password” is correct, the display will show the main menu with the submenus. Use the Up Arrow and Down Arrow keys to select the submenu you want to access or tap directly on the item on the touch screen. After selection press “Enter” and the submenu will be shown. Again use the arrow keys to cycle through the submenu items or tap the item directly. To change a value press “Enter”, insert the new value or parameter and press Enter again. For parameters in tables use the Up and Down Arrow Keys to select the new value for the parameter and press “Enter” again to confirm. Once all modifications in the submenu have been completed, press “Esc” to return to the main menu. There is a submenu called **BLOCK/UNBLOCK** to be able to block its use in case of system maintenance, for security reasons. This option is sent in Block mode to the user.

There is also a start-up confirmation function (not found in the menu). As a precaution, the relay is sent to the user with the Start of use parameter deactivated, which keeps the VED905 inactive to avoid erroneous operation as soon as it is turned on, without the required programming. When powered up for the first time, the user must confirm the start of use.

MAIN SCREENS FOR OPERATION

ETHERNET REPORT

ETHERNET REPORT ER1
LAN CONFIG

IP ADDRESS: ### ## # ## # ## # ## # ## #

NET MASK: ### ## # ## # ## # ## # ## #

GATEWAY: ### ## # ## # ## # ## # ## #

DNS: ### ## # ## # ## # ## # ## #

LINK NOT LINKED CONNECTIONS: ###

ETHERNET REPORT ER7
HTTP / WEB SERVER

USER

USER NAME: V905_WS

PASSWORD: 83397

ETHERNET REPORT ER2
STATUS

HALF DUPLEX FULL DUPLEX

SPEED 10 Mbps SPEED 100 Mbps

Tx: Rx:

LINK CONNECTIONS: ###

ETHERNET REPORT ER8
NTP PROTOCOL

1: a.st1.ntp.br

2: b.st1.ntp.br

3: c.st1.ntp.br

4: d.st1.ntp.br

5: gps.st1.ntp.br

ETHERNET REPORT ER3
ICMP PING

PING ADDRESS: ### ## # ## # ## # ## # ## #

PING RESPONSE TIME: ##### ## # mS

Tx: Rx: PING TIMEOUT

START STOP

ETHERNET REPORT ER4
ICMP MODBUS SLAVE

MODE: [TCP]

PORT: [502]

ENABLE WRITE INHIBITION: TTTT

ETHERNET REPORT ER5
ETHERNET IP

PRODUCED (CONTROL TO NET)

REGISTERS: [M3200 - M3200]

CONSUMED (NET TO CONTROL)

PROGRAM PERMISSION: [TTTTTT] CONNECTED

REGISTERS: [M3200 - M3200]

CONNECT CLASS 3: ### CONNECT CLASS 1: ###

ETHERNET REPORT ER6
FTP / FILE SERVER

USER1

USER NAME: V_FTP_USER

PASSWORD: 833905 [READ ONLY]

USER2

USER NAME: V_FTP_VRX

MODE: [READ / WRITE]

ETHERNET REPORT SCREEN 1 to 8:

There are 8 screens that reproduce the Ethernet Programming Menu, where you can check the different programming conditions without being able to inadvertently change the programming. None of the screens allow commands or changes, with the exception of the ER3 screen, where you can choose an address and command a PING action to check if a certain device on the network is responding.

Later on, the fields of all these screens will be detailed. Here we will only comment on the function of each one of them.

The ER1 and ER2 screens refer to the main Ethernet configuration parameters. On the ER1 screen are the parameters and on the ER2 screen are the Status of the connection.

The ER3 Screen refers to the **ICMP - Internet Control Message Protocol** and it is possible to Ping the address of a certain equipment.

The ER4 screen refers to the **TCP/IP protocol - Transmission Control Protocol (Modbus TCP Server or Modbus Slave)**. Through this protocol, Modbus Over Ethernet communication can be carried out, using all the parameters and addresses described in the Modbus Map at the end of this manual.

The ER5 screen refers to the Internet Protocol (Ethernet IP Server).

The ER6 screen refers to the **FTP - File Transfer Protocol**. Through which you can read and access the files on the memory card inserted in the respective slot of the relay and where the temperature readings, etc. are recorded using a Browser.

The ER7 screen refers to the **HTTP protocol - Hypertext Transfer Protocol**.

The ER8 screen refers to the **NTP protocol - Network Time Protocol** through which you can obtain precise times from predefined NTP servers.

PROGRAMMING

MENU



In the “Programming Menu” there are 16 Sub-items or Submenus available, namely:

- M01: Relay Config.
- M02: Set Nominal.
- M03: Parameters.
- M04: Limits / Rates.
- M05: Actions.
- M06: Protections Delays.
- M07: Set PID.
- M08: Custom Calibration.
- M09: Preset PSP/SSP.
- M10: Filter.
- M11: Modbus.
- M12: Trend Scales.
- M13: Set Clock.
- M14: Test Output.
- M15: Change Passwords.
- M16: Block / Unblock.
- M17: Backup/Restore Data
- M18: Ethernet

M01- RELAY CONFIG

01.1: Regulation Mode: FLD Amp (I-field cte), PWR FCT (PF cte), KVAR cte, FLP/PF and FLD/VAR (Field current cte/Droop by PF or KVAR). The most usual mode for synchronous motors is “Constant Power Factor”, that is, operation at a defined Power Factor even with load and line voltage variations.

If the modes “P. F. Cte” or “KVAR cte”, you can also optionally select the “Double” mode in the “Channel” submenu, so that the VED905 V5L automatically switches to the secondary channel (S) whenever the motor is under load (default switch). FCX closed and/or minimum load reached). When the switch is opened and/or the load is reduced, the channel returns to primary

(P). This guarantees stability with the motor without load and avoids the need to readjust the setpoint.

01.2: Operation Mode (Automatic, Manual Field Current, Manual Open Loop). The choice of manual modes is used for testing and surveying machine curves or emergency operation.

01.3: Control Input 1: You can select None, Starting, FAR, FCX, Up, Down, Force Fied Current, Force Open Loop, Reset, Ext Fail, Firing Fail and Temperature options.

01.2: Control Input 2: You can select None, Starting, FAR, FCX, Up, Down, Force Fied Current, Force Open Loop, Reset, Ext Fail, Firing Fail and Temperature options.

01.3: Control Input 3: (None, Starting, FAR, FCX, Up, Down, Force Fied Current, Force Open Loop, Reset, Ext Fail, Firing Fail and Temperature).

01.4: Control Input 4: (None, Starting, FAR, FCX, Up, Down, Force Fied Current, Force Open Loop, Reset, Ext Fail, Firing Fail and Temperature).

01.5: Setting Mode: (Up/Down, Keyboard, Up/Down + Keyboard) . Setting the work point can be done using any of these options. (The VED905 X5F version has analog setpoint inputs as well)

01.6: Mute Mode: (Manual, Auto, Locked). After the occurrence of an Alarm, the “Mute” or silencing of the same can be executed manually by the Mute button or automatically after the time programmed in the parameter Auto Mute Delay or even by the signal of one of the digital inputs if programmed for Mute. In “Manual” or “Auto”, the Mute command is accepted regardless of acknowledging the faults (Ack) on the alarm screen. In “Locked” the Mute command is not accepted without first acknowledging the faults on the alarm screen.

01.7: Reset Mode: (Manual, Auto, Locked). After the occurrence of an Alarm, the “Reset” or cancellation of the fault condition can be executed manually by the Reset button or

PROGRAMMING

automatically after the time programmed in the Auto Mute Delay parameter, or even by the signal of one of the digital inputs if programmed for Reset . In “Manual” or “Auto”, the Reset command is accepted regardless of clearing the faults (CLR) on the alarm screen. In “Locked” the Reset command is not accepted without first acknowledging the faults on the alarm screen, therefore there is no active alarm at the moment.

01.8: Booster Mode: Pull In Booster (Disabled, Fix On FAR, Fix On FCX, Ramp On FAR, Ramp On FCX). If “Fix On FAR” is enabled, the VED905 V5L applies, when FAR is activated, an excitation current of a pre-programmed value in the Pull In Booster menu, for the time programmed in the Booster Time menu, and then gradually leads to the PSP value with a 2 second ramp. For “Ramp On FCX” the same rules apply, however the Booster is applied when activating FCX. For “Ramp On FAR” and “Ramp On FCX” the Pull In Booster menu value is applied immediately and a ramp up to the SSP value is started. “FAR” modes increase Pull In torque for heavy loads. The “FCX” modes can be used when the start is idling and the load is applied afterwards (with the FCX contact) by means of a clutch for example, thus avoiding a possible de-synchronization at the entrance of an expected heavy load, like coupling a clutch for example.

01.9: Auto to Man Mode: Auto to Manual Transfer (Mantain Process Value, Setting=0%, Setting=50%, Setting=100%, Setting=Nominal, Not Change). In the first option “Mantain Process Value”, a transfer from automatic to manual and vice versa occurs without disturbing the process value (Bumpeless) since the VED905 calculates the ideal value for the Setpoint depending on the readings at the time. The other options, despite being able to take the “Setting” to pre-established values, causing a change in the controlled value (PV), also provides a smooth change with a three-second ramp. In the case of the “Nominal” option, the “Setting” is automatically calculated for the informed nominal value. In the “Not Change” option, the setpoint is not changed (for use in Hot backup, for example).

01.10: Man to Auto Mode: Manual to AutoTransfer (Mantain Process Value, Setting=0%, Setting=50%, Setting=100%,

Setting=Nominal, Not Change). The same observations as in the previous item apply.

01.11: Up Down Start: (“Last Value”, 0%, 50%, 100% and “Nominal”). For cases of use of digital setting of the operating point (Up/Down), whenever the equipment is turned off, on reconnection, the scale value will assume the value programmed in this parameter. “Last Value” is the last scale value used when the equipment was turned off, which is memorized. 0%, 50% and 100% are values that can be preset to start the operation. “Nominal” is equivalent to “setting” calculated automatically by the value entered in the corresponding menu for the parameter to be controlled. Usually 50% is used, as it also corresponds to the nominal value of the parameter to be controlled.

01.12: Four Quadrant: Four Quadrant Operation (No, Yes). The VED905 V5L can operate with loads that lead to an “Overhauling” condition, that is, drag the engine for short periods of time, taking it to the Generator condition. In this case, setting “Yes” prevents loss of PF or KVAR control during these moments. For usual loads, four-quadrant operation is not used.

01.13: Adjust Range: (+/- 20% or +/- 100%). Selecting +/- 100% provides a setting from 100% below to 100% above nominal. Likewise +/- 20% provides adjustment from 20% below nominal to 20% above nominal.

01.14: Channel: Channel Mode (Single or Double): If “Single” is selected, the secondary set point (S) will not be used and only the primary one (P). Even with only the primary setpoint it is possible to work with FP. To use both automatic channels, select “Double”. The advantage of using both channels is being able to optimize the PID for two switchable control modes, for example field current cte for channel 1 and PF cte for channel 2.

01.15: Digital Output 1: (None, Start Permission, FAR, FCX, Alarm, Trip, Opman, PWM Firing). Start Permission, if used, is activated if there is no active fault and the blocking parameter is set to Unblocked and the other system conditions such as cooling time (motor cooling) are OK to start a new start.

PROGRAMMING

FAR informs if the Field is applied, FCX informs if the motor is loaded, Alarm and Trip are usual signals, Opman informs if it is operating in manual and not automatic. PWM Firing is used as a digital output from 1000 to 16000 Hz in PWM to control the IGBT triggering in the power module.

01.16: Digital Output 2: (None, Start Permission, FAR, FCX, Alarm, Trip, Opman). The same observations of item 01.14 apply. Note that this output does not have the PWM Firing option.

01.17: Digital Output 3: (None, Start Permission, FAR, FCX, Alarm, Trip, Opman). The same observations of item 01.14 apply. Note that this output does not have the PWM Firing option.

01.18: Digital Output 4: (None, Start Permission, FAR, FCX, Alarm, Trip, Opman). The same observations of item 01.14 apply. Note that this output does not have the PWM Firing option.

M02-SET NOMINAL

02.1: Motor Voltage.

02.2: Motor Current.

02.3: Nominal Line Current.

02.4: Nominal Line Voltage.

02.5: Nominal KVA.

02.6: Nominal Field Current.

02.7: Nomin. Exciter Transf. Voltage.

02.8: Nominal Powe Factor.

02.9: Line Current Transf. Primary

02.10: Line Voltage Transf. Primary.

02.11: Field Current Transducer. Input.

Values are self explanatory. The screen also informs the measurement to be inserted (Ampere, Volts, etc.). The current transformer (CT) must always have a 1A secondary, that is, either you use a single IN/1A or you use an IN/5A with its secondary passing through a 5A/1A CT. So, for example, the Line Current Transformer Primary for a CT of 1000A/1 A is 1000. For a line current of 1000 amps, for example, you can use a CT of 1000/1, 1200/1, 1500/1 for example . Only the value of the primary is reported.

The Line Voltage Readout (PT) Transformer must always have a 5 VAC secondary. Either a VN/5V PT is used or a VN/115 V PT is used as usual and a second low voltage transformer and power from 115VAC to 5VAC. For a line voltage of 2400 VAC, a TP of 2400 VAC or 2500 VAC or 3000 VAC can be used provided that the value of the primary is informed in this parameter. The Secondary is always 5VAC.

The field current transducer must always have a 5VDC output corresponding to its nominal input value. Only the input value is reported here. For example, for a field with a nominal current of 100A, a 100ADC/5VDC or 150A/5VDC transducer can be used, for example. Usually the manufacturer, Varixx already supplies the 115VAC/5VAC TPS and the 5A/1A CTs in addition to the field current transducer so that the user can use the usual PTs and CTs on the market.

PROGRAMMING

M03- PARAMETERS

03.1: FAR Delay: Time after which, having established the programmed conditions in the FAR Mode menu, the field is applied.

03.2: FCX Delay: Time after which, having established the programmed conditions in the FCX menu, the control mode is changed to Secondary PID with PF cte for example.

03.3: FAR Mode: (Field Application Relay Mode): (Switch + Starting + Delay, Switch + Starting, Switch + Delay, Switch). Establishes the conditions for application of field current and activation of one of the digital outputs if programmed for FAR.

“Switch” refers to an input on the terminals for an external relay to inform the moment of field application (an SPM relay for example). “Starting” is active if the contact connected to the corresponding terminal closes, indicating that the motor has started to start. “Delay” is a programmable delay in the FAR Delay menu. A programmable output (FAR Output) can be used for the VED905 V5L to signal this condition for the field application to be done externally for ring motors with high field current, for example.

03.4: FCX Mode: (Motor Loading Relay): (Delay, Switch, Switch+Delay, Load, Switch+Load, Delay+Load, Switch+Delay+Load). Establishes the conditions for switching to secondary regulation mode (PF or KVAR) and activating one of the programmable digital outputs). “Switch” means that the programmable input is programmed to “FCX Switch” in the Relay Config menu and the corresponding contact is closed. This contact can be an external relay to report charging. “Load” refers to detection of line current above the minimum point entered in the PF Reading Point menu. “Delay” is a delay, programmed in FCX Delay. A programmable output (FCX Output) can be used for the VED905 V5L to signal this condition if necessary.

03.5: New Start Cold: Timing to prevent restarting for the programmed time, according to the motor data sheet, if the motor is stopped and cold. The motor is considered “cold” (Stopped-Cold) if it has stopped and is already running cold (Running-Cold) for a longer period than the time

programmed in this parameter.

03.6: New Start Hot: Timing to prevent restarting for the programmed time, according to the motor data sheet, if the motor is Stopped-Hot. The motor is considered “Hot” if it has stopped before the cooling time running, that is, it is still in the Running-Hot condition and stopped afterwards. In this case, the delay in this menu is applied for a new start.

03.7: Auto Mute Delay: Time to perform “Auto Mute”. See details in the Mute Mode item.

03.8: Auto Reset Delay: Time to perform “Auto Reset”. See details in Menu Item Reset Mode.

03.9: Trip Pulse Time: (0.1 to 1000 Seconds or infinite). Duration time of the Fault Pulse or Trip on the corresponding terminal. If set to “0” it will be interpreted as infinite time.

03.10: Motor Start Time: Motor starting time, used for Starting Too Long detection. Measured after the occurrence of the “Starting” signal.

03.11: Booster Time: Booster time for both pulse and ramp options. During this time, a greater current is applied to the field to provide greater torque and avoid loss of synchronization.

03.12: Two Quadrant Mode: (Normal/50%, 0/100%). Typically used at Normal/50%.

03.13: Under Excitation Limit: (No, Yes). Selects the function to maintain a minimum current delivered to the machine field, avoiding operation with low excitation current with risk of loss of synchronism (Step Out) or outside the stability range of the machine, in case of loss of control or operator error.

03.14: Over Excitation Limit: (No, Yes). Selects the function to limit the maximum current delivered to the machine field, avoiding possible overheating or out of machine stability range, in case of loss of control or operator error.

03.15: Lead Angle Limit: (No, Yes). Limitation of the polar angle excursion in advance below the programmed limit.

PROGRAMMING

3.16: Lag Angle Limit: (No, Yes). Limitation of polar angle excursion delayed below the programmed limit.

3.17: Process Limit: (No, Yes). If set to Yes, it allows the operation of limitation of Under and Over field currents and Lead / Lag (Capacitive and Inductive polar angles) calculated by the process (control PID) in addition to the limitation by not allowing the Setpoint excursion to values that exceed those limits and fixed values programmed in the corresponding menus and enabled in the menus above. (Usually No is used because fixed limits are reliable.)

3.18: PF Polarity: Allows you to easily correct the correct Power Factor reading without having to reverse field wiring.

3.19: PF Reading Point: (1% to 100%). With respect to rated line current. PF reading start level and operation in PF cte if this option has been selected and "FCX" is active. Below this point the PF reading is forced to 1 to avoid instability and operation is maintained at constant field current.

M04: Limits / Rates.

In this menu, the limitation values are set or for the functions of "Limitation of values" and of actuation of alarm and trip, for the protections, in addition to the rates (Rates) "Droop Rate", "Compound Rate", "Limiting Gain" and "Pull In Booster Level".

4.1: Under Current Level: Line Undercurrent fault actuation level.

4.2: Over Current Level: Line Overcurrent fault actuation level.

4.3: Under Voltage Level:
Line Undervoltage fault actuation level.

4.4: Over Voltage Level: Line overvoltage fault actuation level.

4.5: Under Power Level: Underpower fault actuation level.

4.6: Overpower Level: Overpower fault actuation level.

4.7: Under Excitation Limit: Excitation Undercurrent limitation level (in relation to nominal). Note that this is not a "Trip" level, but a level in which the VED905 V5L limits the excitation current excursion even if the process or erroneous commands request its decrease. This is to prevent possible loss of synchronism or operation outside the normal range.

4.8: Over Excitation Limit: Excitation overcurrent limitation level (in relation to nominal). Note that this is not a "Trip" level, but a level in which the VED905 V5L limits the excitation current excursion even if the process or erroneous commands request this increase.

4.9: Under Excitation Level: Field Undercurrent fault actuation level. This level must be set to values lower than parameter 4.7.

4.10: Over Excitation Level: Field Overcurrent fault actuation level. This level must be set to values greater than parameter 4.8.

PROGRAMMING

4.11: Lead Angle Limit (0 to 1.00 in P.F.). Angle limitation level in advance. Note that this is not a “Trip” level, but a level in which the VED905 V5L tries to maintain the polar angle even if the process or erroneous commands request it to advance.

4.12: Lag Angle Limit (0 to 1.00 in P.F.). Delay Angle limitation level. Note that this is not a “Trip” level, but a level in which the VED905 V5L tries to maintain the polar angle even if the process or erroneous commands request it to advance.

4.13: Lead Angle Level (0 to 1.00 in P.F.): Leading polar angle fault actuation level. This level must be set to values lower than parameter 4.11.

4.14: Lag Angle Level (0 to 1.00 in P.F.): Lag polar angle fault actuation level. This level must be set to values lower than parameter 4.12.

4.15: Droop Rate (0 to 100%): Droop level (in relation to the rated field current) that the VED905 V5L applies to perform the correct KVAR or PF divisions between the machines operating in parallel, on the same load (Tanden) in "Tanden" mode. Cte Field Current". The set level of “Droop” is reached for a fully inductive theoretical power factor, or intermediate values for intermediate Power Factor values. The “FLD/PF or FLD/VAR modes can be set in menu 1.01 to have the real field current calculated taking into account the Power Factor or KVAR at the moment.

4.16: Compound Rate (1 to 100%): Compound Rate in relation to the other factor involved (field current) that the VED905 V5L considers to operate. Note that it is only valid for “Power Factor cte” or “KVAR cte” mode. You can operate with a rate from 10 to 100%. For pure PF cte or KVAR cte operation, there may be a tendency to instability, depending on machine response time and load characteristics. The compoudage, between 50 to 80%, in this case allows the operation with practically constant PF or KVAR but maintaining a small portion of the primary factor (field current) to achieve stability.

4.17: Limiting Gain (10 to 5000 x 0.01): Proportional Gain, used momentarily, in case of limiting function input. Allows you to optimize

stability during the active throttling time. It is only valid in the case of using Limitation by process, a condition chosen in another menu.

4.18: Pull In Booster (10 to 100%): Value of the field overcurrent (booster) that will be applied for the time defined in the Booster time parameter and at the defined application time.

PROGRAMMING

M05: Actions.

In this menu it is possible to program the actions that will be taken in each of the possible failures. The options for all faults are: "None", "Alarm", "Inhibit", "Trip", "Both", "Force Field Current" and "Force Open Loop".

If "**None**" is selected, fault detection will be disabled. If "**Alarm**" is selected, only the alarm screen and the alarm contact will be activated, the excitation will remain active and the Trip contact will not be activated.

If "**Inhibit**" is selected, in case of occurrence of the fault, the excitation will be inhibited, in addition to the alarm screens and Alarm contact being triggered. Trip's contact will not be triggered.

If the "**Trip**" option is selected, in the event of a failure, the "Trip" contacts will be activated together with the Alarm condition and the "Alarm" contact. Excitement will not be inhibited. If the "**Both**" option is selected, in addition to what happens with the "Trip" option, excitation will also be inhibited. In case of selection "**Force Open Loop**" or "**Force Field Current**", in case of fault occurrence, VED905 V5L will pass to "**Manual Open Loop**" or "**Manual Field Current**" mode respectively, while VED905 V5L is not turned off or used the "Reset Force Mode" command. The faults that can be programmed are as below. Note that for fault detection to occur, the option must not be "None" and that the fault condition established in **Menu M04: Limits**, corresponding to this fault, remains active for the time established in **Menu M06: Delays**, also corresponding to this failure.

- 5.1: Under Voltage Action.
- 5.2: Over Voltage Action.
- 5.3: Under Excitation Action.
- 5.4: Over Excitation Action.
- 5.5: Lead Angle Action.
- 5.6: Lag Angle Action.
- 5.7: Under Current Action.
- 5.8: Over Current Action.
- 5.9: Under Power Action.
- 5.10: Over Power Action.
- 5.11: Exciter Over temperature.
- 5.12: External Fail.

- 5.13: Field Loss.
- 5.14: Firing Fail.
- 5.15: Lost Control.
- 5.16: Start too Long

M06: Protections Delays

In this menu, the delays for Detection of each fault are set. Note that set values are multiplied by 0.1 seconds. For example, a value of 10 must be set to 1 second. These times serve as a filter for spurious conditions, avoiding fault detection due to a possible process transient. Adjustment range for all delays below: 0 to 10000 x 0.1 s.

- 6.1: Under Voltage Delay.
- 6.2: Over Voltage Delay.
- 6.3: Under Excitation Delay.
- 6.4: Over Excitation Delay.
- 6.5: Over Lead Angle Delay.
- 6.6: Over Lag Angle Delay.
- 6.7: Under Current Delay.
- 6.8: Over Current Delay
- 6.9: Under Power Delay
- 6.10: Over Power Delay
- 6.11: Exciter Over temperature Delay.
- 6.12: External Fail Delay.
- 6.13: Field Loss Delay.
- 6.14: Firing Fail Delay.
- 6.15: Lost of Control Delay

PROGRAMMING

M07: SET PID.

In this menu, all the parameters related to the digital error amplifier with PID action (Proportional, Integral and Derivative) are set. This is an "Independent PID" type PID. The equation that governs this PID is:

$$CV_{out} = (K_p * Error) + (K_i * Error * dt) + (K_d * Derivative) + CV_{Bias}$$

On request, the version with "ISA PID" with equation can also be supplied:

$$Cv_{out} = K_p * (Error + (Error * dt / T_i) + (T_d * Derivative)) + CV_{Bias}$$

If the process constants are known, the formulas below are valid. Otherwise, the "Auto Tune PID" function can be used, which is done automatically by the VED905 V5L or even by trial and error.

If K, Tc, and Tp are known one can use the equations below to estimate the initial values for Kp, Ki, and Kd in a Proportional / Integral / Derivative (PID) control:

$$K_p = (1.2 * T_c) / (K * T_p)$$

$$K_i = (0.6 * T_c) / (K * T_p * T_p)$$

$$K_d = (0.6 * T_c) / K$$

Tc and Tp are in units of time. On the VED905 V5L, these values must be expressed in 10 mS intervals (eg "100" = 10 mS * 100 = 1 second).

If only Proportional control is desired (Ki and Kd = 0), use the equation:

$$K_p = T_c / (K * T_p)$$

Or for Proportional / Integral (Kd = 0), use the equations:

$$K_p = 0.9 * T_c / (K * T_p)$$

$$K_i = 0.3 * K_p / T_p$$

These equations are known as Ziegler-Nichols, which were developed by John Ziegler and Nathaniel Nichols.

7.1: Dead Band Canal 1 (P): (0 to 1000). Deadband over total excursion of 32000. Normally set to "0". Within the deadband, no offset corrections are made.

7.2: Dead Band Channel 2 (S): (0 to 1000). Deadband over total excursion of 32000. Normally set to "0". Within the deadband, no offset corrections are made.

7.3: Derivative Sensivity Canal 1 (P): (Normal / Reduced).

7.4: Derivative Sensivity Channel 2 (P): (Normal / Reduced).

7.5: Integrative Clamping Channel 1 (Yes / No).

7.6: Integrative Clamping Channel 2 (Yes / No).

7.7: Proportional Gain - Channel 1 (P): (0 to 65535 x 0.01). Proportional Gain.

7.8: Proportional Gain - Channel 2 (S): (0 to 65535 x 0.01). Proportional Gain.

7.9: Derivative Time Channel 1 (P): (0 to 65535 x 0.01 sec.). Derivative Gain. Defines the forward correction as a function of the error changing speed gradient.

7.10: Derivative Time Channel 2 (S): (0 to 65535 x 0.01 sec.). Derivative Gain. Idem.

7.11: Integrative Rate Canal 1 (P):(0 to 65535 r/1000 s). Defines the slow correction, with a long time and tending to zero error, that is, maximum correction.

7.12: Integrative Rate Channel 2 (S):(0 to 65535 r/1000 s). Idem.

7.13: Slew Time Channel 1 (P): (0 to 1000 s). Time for variation of the entire excursion in the PID virtual amplifier control output. Usually used 1 sec.

7.14: Slew Time Channel 2 (S): (0 to 1000 s). Idem.

7.15: Derivative Term Channel 1 (P): (Error = PV-SP) or PV = Process Value). To command the derivative term. Typically used in Error.

7.16: Derivative Term Channel 2 (S): (Error = PV-SP) or PV = Process Value). Idem.

7.17: PID Low Clamping Canal 1 (P): (0 to 32000). Limitation of the relative value that the control variable can assume at any time. The lower limit must always be set to values smaller than the upper limit.

7.18: PID Low Clamping Channel 2 (S): (0 to 32000). Idem.

7.19: PID High Clamping Channel 1 (P): (0 to 32000). Limitation of the relative value that the control variable can assume at any time. The upper limit must always be set to values greater than the lower limit.

PROGRAMMING

7.20: PID High Clamping Canal 2 (S): (0 to 32000). Idem.

7.21: PID 1 Clamp Mode (P): (Manual, Automatic). If set to Manual, the clamping value entered in the corresponding parameter will be considered. If Automatic is set, the VED905 V5L calculates this value based on other data entered. Typically used in Manual.

7.22: PID 2 Clamp Mode (S): (Manual, Automatic). Idem.

7.23: PID 1 Bias. (P): (-32768 to 32767). Typically used at 16000.

7.24: PID 2 Bias. (S): (-32768 to 32767). Typically used at 16000.

7.25: PID 1/2 Error Mode: (Normal, Inverse). Typically used in Normal.

M08: Custom Calibration.

In this menu it is possible to perform digital calibrations for the reading of several magnitudes, compensating the errors of the Transducers, Voltage and Current Transformers used by the user in the interface in the Power module in case of exchanges. On the screens you can read the value to be corrected and the correction factor to be introduced in real time. The correction factor is a multiplier of the current read value. (0 for "Zero of Scale" and 1 for "End of Scale" do not introduce correction).

8.1: Line Voltage Calibration. Zero (-1000.00 to +1000.00) and Scale (0.000 to +10.000).

8.2:: Line Current Calibration. Zero (-1000.00 to +1000.00) and Scale (0.000 to +10.000).

8.3: Field Current Calibration. Zero (-1000.00 to +1000.00) and Scale (0.000 to +10.000).

8.4: Power Factor Calibration. Zero (-0.50 to 0.50) and Scale (-10.00 to +10.00).

M09: Preset PSP/SSP.

In this menu it is possible to insert preset setpoint values for when there is a change from a channel (P) to (S) or vice versa for the first change, that is, when the setpoint that is not in use cannot be set by Up/Down it will be pre-set by these parameters, and when changing this value it will be assumed and later on it can be operated by Up/Down normally. Usually used at 50% which corresponds to nominal values of the controlled parameters.

M9.1: Primary Setpoint (P): can be used to set the primary setpoint value when operating on the secondary setpoint.

M9.2: Primary Setpoint (P): used to set the secondary setpoint value when operating on the primary setpoint.

M10: Filter.

In this menu you can set the filtering depth in four reading inputs. The filters are of the "Averaging" digital type. Setting too much filter can lead to system instability as it introduces first order delay. Use a compromise value between reading stability of values and control stability. (0 = No filtering). Normally 0 to 5 are used.

10.1: Input Filter 1 LV (0 - 99). Line Voltage.

10.2: Input Filter 1 LC (0 - 99). Line Current.

10.3: Input Filter 1 FC (0 - 99). Field current (Field Currente).

10.4: Input Filter 1 PF (0 - 99). Power factor (Power Factor).

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M11: MODBUS

In this menu you can set the parameters of the “Modbus RTU Slave” communication protocol. The VED905 V5L features an RS232C communication port that can be externally connected to a “Master” (Point to Point) or via an RS485 converter to be connected to a Modbus network (Droop Out). The protocol used is Modbus RTU (Remote Terminal Unit). Optionally, it can be requested with Modbus ASCII Protocol or other “Baud Rate” and “Handshake”.

Communication can optionally be provided with CAN protocol CsCAN or Devicenet.

Through the Modbus RTU network you can set and read parameters and variables and virtually have total control over the system. Programming the “Master” for system operation is a user assignment. Varixx provides the bulletin with the addressing of relevant records (memory map).

Important: Every time Modbus parameters are changed in the menu or Modbus communication is turned off and on in this menu, the VED905 V5L power supply must be turned off and on again. Once this has been done, the change is valid indefinitely even if the equipment is turned off.

11.1: Node (Address): (1 to 247). This is the Address of the VED905 V5L within the network.

11.2: Baud Rate: (9600, 19200 and 38400). Data transfer rate speed. You can optionally provide version with other values.

11.3: Parity: (None, Odd and Even). Use or Not of the parity bit, Parity Even or Parity Odd.

11.4: Handshack: (None, Xon/Xoff, CTS/RTS). Respectively: Unused, Hardware and Software (Clear to Send / Request to Send).

11.5: Timeout: (0.1 to 102.3 S). Time for communication failure detection.

11.6: Modbus ON/OFF: (On, Off) To enable or disable Modbus communication. If not used, leave it on Off. This screen will show the current status.

M12: TREND SCALES

In this menu, the reading scales are set for the various graphs available. Note that the graph always shows a scale from 0 to 100% on the vertical axis. 100% corresponds to the scale set in this menu. For example, if 3000 A is set as the Line current scale and the line is at 50% in the graph, the read value corresponds to 1500A.

M12.1: Line Current Scale: (1 a 10000 A)

M12.2: Line Voltage Scale: (1 a 65535 V)

M12.3: KW Scale: (1 a 65535 KW)

M12.4: KVA Scale: (1 a 65535 KVA)

M12.5: KVAR Scale: (1 a 65535 KVAR)

M12.6: Field Current Scale: (1 a 9999 A).

M12.7: Enable Plot Reset:(No, Yes). If Yes is set, when touching the button with the trending index from 1 to 16, the curve is restarted. In No this action is inhibited.

M13: Set Clock

In this menu you can set the internal real time clock. It is normally never necessary to service this watch other than replacing the internal backup battery, which typically lasts over 10 years on the shelf and over 15 years in normal use.

M13.1: RTC Date.

M13.2: RTC Time.

M14: Teste Outputs

In this menu you can test the 4 digital outputs. Note that this test cannot be performed with the VED905 V5L in Running mode (with the engine running).

M14.1: Test Output 1.

M14.2: Test Output 2.

M14.3: Test Output 3.

M14.4: Test Output 4.

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M15: PID Autotune.

In this menu you can control the PID Autotune function. In this case, the VED905 V5L exercises a step in the control and measures the reaction time of the system, in order to calculate, according to the equations already defined, the best theoretical adjustment point. You can view and manually make corrections to the values in M07:PID. Choose the line "Start Autotune" and press "Enter" or press "Esc" to exit the menu or 'Return' to return to the main menu.

IMPORTANT NOTE: in this action there will be a great instability or change in the working point of the machine and for this reason it should be used as a last resort. One should initially try to find the best PID setting manually and only perform Autotune under controlled conditions to try to improve stability in difficult systems.

Usually the factory settings are already very close to the ideal settings for most cases. After performing the Autotune, check the values automatically set in the PID parameters in the M07: PID menu and try to slightly adjust them if you are still not satisfied with the stability.

M16: Change Passwords

In this menu you can change the Programming, Force and Clear passwords, which are independent. For example, the operator can only be provided with the Force password or the Clear password or both, but not the programming password, which will only be in possession of the engineering staff.

M15.1: Change Prog Pass.

M15.2: Change Force Pass.

M15.3: Change Clear Pass.

M17: Block/Unblock

In this menu, you can change Block the operation of the VED905 V5L, for example to perform maintenance, without the operations staff being able to start the engine. In practice, being in Blocked means that the Start Enabled signal will not be active, so once this signal is used in the command line of the circuit breaker or motor starting contactor, it will not be possible to start it.

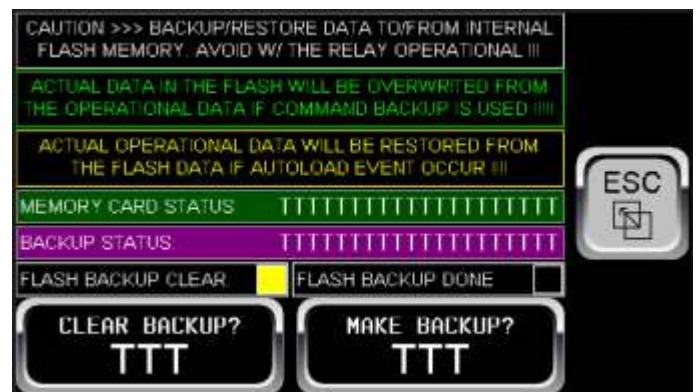
M18- BACKUP / RESTORE DATA

M18.1- Enable Autorun: Auto Run must be enabled as well as Auto Load if it is desirable to have the Fail-Safe system operational. After Auto Load performed, if the relay detects that the program is missing or corrupted.

M18.2- Enable AutoLoad: It must be enabled in the same way as described above.

M18.3- Flash Backup: This sub-menu takes you to the screen below where you can clean the previously executed backup or execute a first or new backup of all the Ram memory to the internal Flash memory. This internal backup is used in case of a Fail-Safe action with Auto Load and Auto Run.

Only execute the Make Backup command after having all the parameters programmed and making sure that the relay is operating correctly and without active faults or not cleared in the alarm screen.



In addition to the Clear Backup and Make Backup buttons and the Cleared or Done indications, there is a memory card status field, as described before, and a Backup Status field which can be: 1- STANDBY / 2- OK - PROCEED / 3- ERROR - CHECK CARD / 4- DONT BACKUP ON FAIL / 5- OK - DONE / 6- WRITING / 7- READING / 8- BUSY.

Note that the Clear Backup and / Make Backup command buttons become invisible if the conditions for these commands are not currently suitable.

PROGRAMMING

M18.4- CLONE PARAMETERS

This sub-menu takes you to the Clone Parameters screen below.

ATTENTION: This action, if commanded «Restore», will overwrite all the programming parameters with those contained in the memory card, in the specific file.

To use this function, a previously formatted memory card, with a maximum of 32 Gb, must be inserted in the top slot of the relay. You can command «Backup» to write a new file with the data or «Restore» to restore them.

This way, if several VED905 V5L Relays are used with the same programming, just program one of them and clone the data in the other relays.

This action does not save or restore the programming password, which is actually one of the parameters.

On the screen below you can see that there are two fields, one with the card status messages as described in the explanation of the Info 4 screen and another with the Backup status messages which are: 1- STANDBY / 2- OK - PROCEED / 3- ERROR - CHECK CARD / 4- DONT BACKUP ON FAIL / 5- OK - DONE / 6- WRITING / 7- READING / 8- BUSY.

Note that the Backup and Restore command buttons are invisible if the conditions for these commands are not currently suitable.

Note: Unlike the Flash Backup command, which copies the entire RAM memory to an internal non-volatile memory, the Clone Parameters command described here only saves the parameter values entered in the programming menu and serves as documentation to be kept, as a possible restoration of parameters to a previous condition when changes are made in the programming or, as already mentioned, cloning the same parameters in other relays of the same plant for example.

To clone the parameters to other relays, copy the «Datacard» file from the memory card of the relay that generated the file to be cloned to the cards of the other relays to a computer and then execute the Restore command on each one of them. Attention: In this case, be careful not to execute the Backup command on the other relays, before executing the Restore command.



M19- ETHERNET

The **VED905 V5L** relay has ETHERNET communication and can be accessed from anywhere on the planet. Several communication protocols are incorporated, the user just needs to define the communication parameters in the following programming screens and use it.

You can, for example, get all temperature readings and flag states from a computer or mobile device or even interface with a DCS system anywhere as long as you have access to Ethernet and the relay is connected to a local network LAN with access to an external WAN network and the addresses programmed in the relay are known.

If necessary, the relay can be parameterized remotely, for example, alarm and trip levels, etc.

It is also possible for the manufacturer to update the firmware remotely, if necessary.

The available protocols are:

ICMP - Internet Control Message Protocol.

SRTP - Service Request Transport Protocol.

TCP/IP - Transmission Control Protocol (Modbus TCP Server ou Modbus Slave).

ETHERNET/IP - Internet Protocol (Ethernet IP Server).

FTP - File Transfer Protocol

HTTP - Hypertext Transfer Protocol..

NTP - Network Time Protocol.

It is not the intention of this manual to go into depth of each of the protocols. It is up to the user to know the protocol he intends to use.

Below is a brief description of each Protocol and their limitations in this application.

ICMP - Internet Control Message Protocol. Internet Control Message Protocol), is an integral protocol of the IP Protocol, defined by RFC 792, is used to communicate network layer information, the most common use is to provide error reports to the original source. Any computer that uses IP needs to accept ICMP messages.

Although several tools are possible in this protocol, the VED905 V5L relay only implements the Ping function, which can be used to check whether a device is responding to commands, that is, it is accessible on the network.

SRTP - Service Request Transport Protocol. Service Request Transfer Protocol (SRTP) is a GE Fanuc Automation protocol, which allows a remote SRTP client to request services from an SRTP server. In that In this case, the VED905 V5L relay, which acts as an SRTP server, responding to requests from one or more SRTP Clients.

As SRTP was originally designed to support the services provided by the GE Fanuc Series 90, the SRTP protocol of the VED905 V5L does not support all possible SRTP services. The implementation of SRTP by ReléVED905 V5L is mainly limited to the services necessary for the exchange of registration data.

Settings:

Port Used: 18245 TCP

Maximum number of connections: 16

PROGRAMMING

The following SRTP service requests are supported by the VED905 V5L Relay.

0 PLC_SSTAT
 1 PLC_LSTAT
 4 READ_SMEM
 7 WRITE_SMEM
 33 CHG_PRIV_LEVEL
 67 RET_CONFIG_INFO
 79 SESSION_CONTROL
 97 PLC_FEATURES_SUPP

Tipos de Registro:

8 %R 16 bit
 10 %AI 16 bit
 12 %AQ 16 bit
 16 %I 8 bit
 18 %Q 8 bit
 20 %T 8 bit
 22 %M 8 bit
 30 %S 8 bit
 70 %I 1 bit
 72 %Q 1 bit
 74 %T 1 bit
 76 %M 1 bit
 84 %S 1 bit

TCP/IP - Transmission Control Protocol (Modbus TCP Server). The TCP/IP protocol is an acronym for Transmission Control Protocol, used to send and receive data on the web.

The TCP/IP protocol is the language of computers and specifies how data is exchanged over the internet.

Most computers talk over TCP/IP, providing end-to-end communications.

Highly scalable and widely used, this protocol requires little central management and is designed to make networks reliable and self-healing in the event of any device failure. Each device has an IP address that identifies it, allowing it to communicate and exchange data with other connected devices.

Settings:

Port Used: 502 TCP

Maximum number of connections: 16

Note: Modbus must be enabled on the VED905 V5L relay.

IP - Internet Protocol (Ethernet IP Server). The IP protocol is the network layer communication protocol in the Internet protocol suite for relaying datagrams across network boundaries. Its routing function allows for the interconnection of networks and essentially establishes the Internet.

IP is tasked with delivering packets from the source host to the destination host based solely on the IP addresses in the packet headers. For this, IP defines packet structures that encapsulate the data to be delivered. It also defines addressing methods which are used to label the datagram with source and destination information.

Settings:

Ports Used: 44818 TCP or 2222 UDP

Maximum number of Connections: 2

Start Send (Produced) Register = R4001 /// Words Count = 248

Start Received (Consumed) Register = R4501 /// Words Count = 200 /// Status Register = R553

FTP - File Transfer Protocol is the protocol that allows transmission of files over the network. Through it it is possible to read and have access to the files of the memory card inserted in the respective slot of the relay and where the temperature readings, etc. are recorded. It is a hardware independent standard/generic protocol over a way to transfer files and it is also a transfer program.

Data transfer over computer networks typically involves transferring files and accessing remote file systems (with the same interface used for local files). FTP is based on TCP, but predates the TCP/IP protocol stack and was later adapted to it. It is the default for transferring files.

Settings:

Ports Used: 20 and 21 TCP

Maximum number of Connections: 4

User Name 1 (Read Only) = V_FTP_USER /// Password = 833905 /// User Name 2 (Read / Write) = V_FTP_VRX /// Password = 87995

HTTP - Hypertext Transfer Protocol.

The Hypertext Transfer Protocol is a communication protocol (at the application layer according to the OSI Model) used for distributed and collaborative hypermedia information systems. It is the basis for World Wide Web data communication.

Hypertext is structured text that uses logical links (hyperlinks) between nodes containing text. HTTP is the protocol for exchanging or transferring hypertext.

Settings:

Port Used: 80 TCP

Maximum number of Connections: 1

User Name: = V905_WS

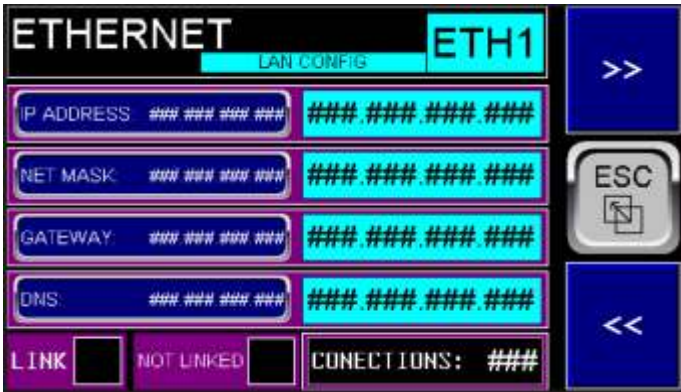
Password: 93397

NTP - Network Time Protocol. NTP is a protocol for synchronizing equipment clocks based on the UDP protocol over port 123. It is used for clock synchronization of a set of equipment and devices in data networks with variable latency. NTP allows you to keep the clock of an equipment synchronized with the time always right and with great accuracy.

Configuration: Five NTP server addresses in Brazil are predefined. On request we can define any other world server.

Factory default Servers are as follows.

a.st1.ntp.br
 b.st1.ntp.br
 c.st1.ntp.br
 d.st1.ntp.br
 gps.st1.ntp.br



M19A-ETHERNET-LAN CONFIG

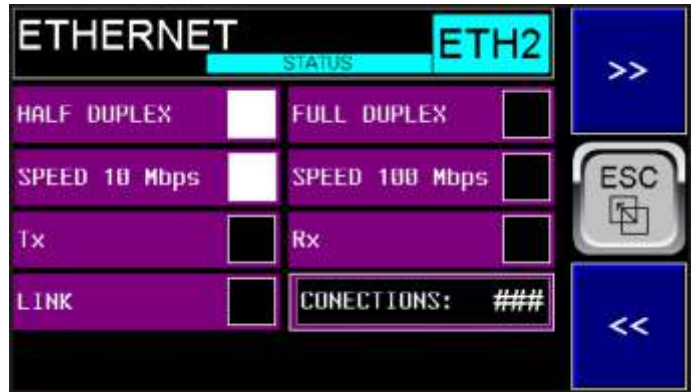
M19A.1- IP ADDRESS: Enter the address of what the VED905 V5L relay will have on the LAN.

M19A.2- NET MASK: Enter the number referring to the net mask. Usually 255.255.255.0

M19A.3- Gateway: Enter the Gateway number if necessary. If not needed, leave it at 0.0.0.0

M19A.4- DNS: Enter the Domain Name Server address if necessary. If not used leave 0.0.0.0

This screen also shows whether the Ethernet cable is connected or not and the number of connections. **Note:** the number of connections may eventually show «zero» even when connected if the transmissions are not repetitive and because they are very fast there is not enough time to show them on the screen.



M19B-ETHERNET-STATUS

This Screen only shows the different Status of the connection, not having any field to be inserted.

The Status Shown are:

M19B.1- HALF DUPLEX or FULL DUPLEX: Shows the Connection Mode.

M19B.2- SPEED 10 Mbps or 100 Mbps: Shows the connection speed

M19B.3- Tx and Rx: Shows whether data is being transmitted or received.

M19B.4- LINK: Ethernet cable is connected (Link) or not and the number of connections. Note: the number of connections may eventually show «zero» but it will be connected if the transmissions are not repetitive and because it is very fast there is not enough time to show it on the screen.



M19C-ETHERNET-ICMP (PING)

This screen, just like the corresponding screen in the Report Menu, allows you to test whether a certain network device is responding, that is, it is active on the network.

M19C.1- PING ADDRESS: Enter the address to perform the ping.

M19C.2- PING RESPOND TIME: Shows the time in milliseconds that the equipment took to respond.

M19C.3- Tx and Rx: Shows whether data is being transmitted or received.

M19C.4- PING TIMEOUT: If the equipment does not respond in less than 1 second, it will indicate Timeout, that is, it is not responding.

M19C.5- START and STOP: Starts and stops PING. When exiting the screen, a Stop is automatically given.

PROGRAMMING



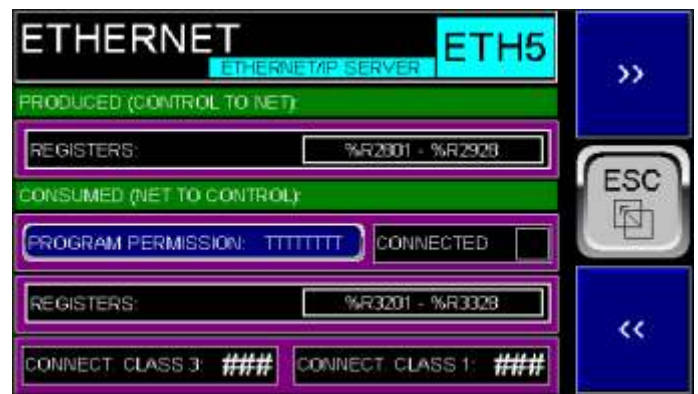
M19D- ETHERNET - TCP/IP PROTOCOL - MODBUS SLAVE

This screen refers to the main protocol of the **VED905 V5L** relay, which allows full Modbus operation, with all functionalities and valid addresses, in addition to offsets, etc. A program, provided free of charge by Varixx, allows, among other functionalities, to completely test the Modbus Over Ethernet connection with a computer connected to the **VED905 V5L** relay..

M19D.1- MODE: Informational field only. Shows the mode (Always TCP).

M19D.2- PORT: Informational field only. Show port (Always 502)

M19D.3- ENABLE WRITE INHIBITION: Select YES or YES to inhibit any possibility of writing to internal parameters of the VED905 relay, thus increasing security. Readings of any registers or parameters, Readings, Flags, etc remain functional if writing inhibition is selected as Yes or Yes. Note: Always prefer to program the parameters directly on the relay or through the memory card, as described in this manual, for safety.



M19E- ETHERNET IP PROTOCOL

This screen refers to the Ethernet IP protocol. Unlike the TCP/IP (Modbus Over Ethernet) protocol described above, data read and written will be transferred all at once, respecting the maximum number of words, as described below.

M19E.1 - PRODUCED REGISTER (to be read): Informational only. Always R2801 to %R2928.

M19E.2 - PROGRAM PERMISSION: Choose "Enable" to allow writing to the "Consumed" register.

M19E.3 - CONSUMED REGISTER (to be written): Always %R3201 to %R3328.

M19E.4 - CONNECT CLASS 3: Informational only.

M19E.5 - CONNECT CLASS 1: Informational only.

PROGRAMMING

M19F- ETHERNET - FTP PROTOCOL - FILE TRANSFER PROTOCOL

This screen refers to the protocol that allows readings and copies of files stored on the memory card of the VED905 relay, allowing to obtain data from historical records of temperature readings, for example. To access any file on the card one must know the file name as recorded on the card. You must use the file name and its complete path (with directories and subdirectories, if any), as in the examples below.

Assuming that the relay IP is 192.168.1.10 and you want to read the log.txt file which is in the root of the card directory Then write in the search field:

192.168.1.10/log.txt and press Enter.



A screen will appear asking for Login and Password. Once you have entered the correct login and password data, the file will be read and can be saved on your computer.

M19F.1- USER 1 - USER NAME: Informative only. Always V FTP_USER.

M19F.2- PASSWORD: Informative only. Always 833905

M19F.3- READ ONLY. Informative only.

M13F.4- USER 2 - USER NAME: Informative only. Always V FTP_VRX

M19F.5- PASSWORD: Informative only. Always 87995.

M19G- ETHERNET - HTTP PROTOCOL - WEB SERVER

This screen refers to the HTTP or HTTPS protocol that allows communication with Browsers using **Hypertext Transfer Protocol**.

M19G.1- USER NAME: Informative only. Always V905_WS.

M19G.2- PASSWORD: Informative only. Always 83397

M19H- ETHERNET NTP PROTOCOL

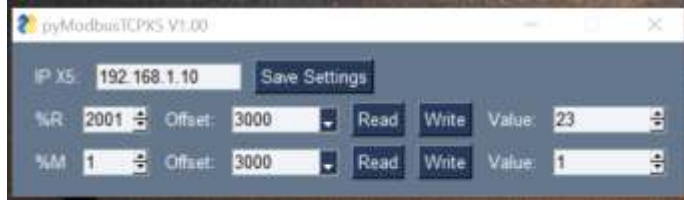
This Screen refers to the Ethernet Network Time Protocol, through which devices can obtain exact time data from previously established servers.

M19H.1 to M19H.5- List of pre-established servers.

TESTING THE ETHERNET CONNECTION

USING A WINDOWS COMPUTER

A simplified way to test the ETHERNET connection is described below, using simple executable software provided by Varixx or any similar program available on the world wide web). Let's consider here the explanation using the executable **pyModbusTCPV5**



1- Initially connect the suitable RJ45 cable between the computer and the LAN port of the VED905 V5L relay and open the Windows Settings and select the **Network** and **Internet** option, which will open the properties screen that will contain content as shown below, among others.



2- Click on the option «Change adapter options». The following screen will open, in which an unidentified Ethernet connection should appear, in addition to the other existing connections.



3- Right-click the unidentified Ethernet connection. The following screen will open.



4- Double-click on the Internet Protocol Version 4 (TCP/IPv4) option. The following screen will open.



4- Enter an IP address that is different from your local network, for example if your network is **192.168.0.1** and press OK. you must use a network that has the third digit different from it. For example, we use **192.168.1.11** and in the **pyModbusTCPV5** program we use **192.168.1.10** so the computer's address on the network will have the termination **11** and the **VED905 V5L** relay will have the termination **10**. At this point the two devices should already be connected and exchanging data. On the **VED905 V5L** relay, on the Menu screen, choose option **16. REPORT** and then the option **ETHERNET REPORT / STATUS**. Then go to the **ER3** screen and activate the **START** option to test the connection with **PING**.



If the connection is OK, it will indicate a response time in the **PING RESPONSE TIME** field, which should be around 0.01 mS. If the connection is not OK, it will indicate **PING TIMEOUT** and the **PING RESPONSE TIME** field will be all +++++.

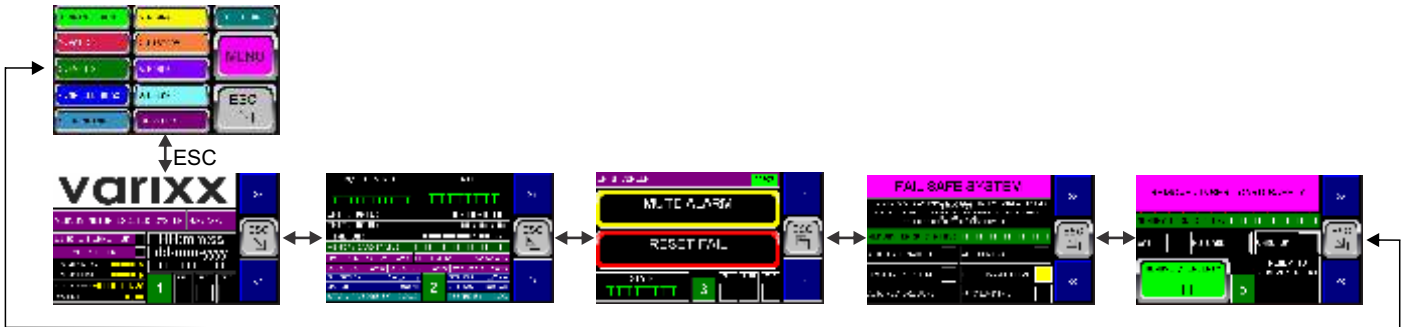
If the connection is OK, open the **pyModbusTCPV5** executable program and enter the chosen address, in this example **192.168.1.10** and click Save Settings. Choose a register to be read, for example **%R4001**, which will contain the value of the first reading, plus the necessary offset according to the Modbus tables in this manual and click Read. The current temperature should appear in the Value field. In the same way, flags of type **%M** can be read.



Attention: You can also write to the registers, but avoid this if you don't know that a certain register can be overwritten, as it could change configuration parameters of the VED905 V5L relay. **Never use this type of test with the VED905 operating with the engine.**

SCREEN FLOW

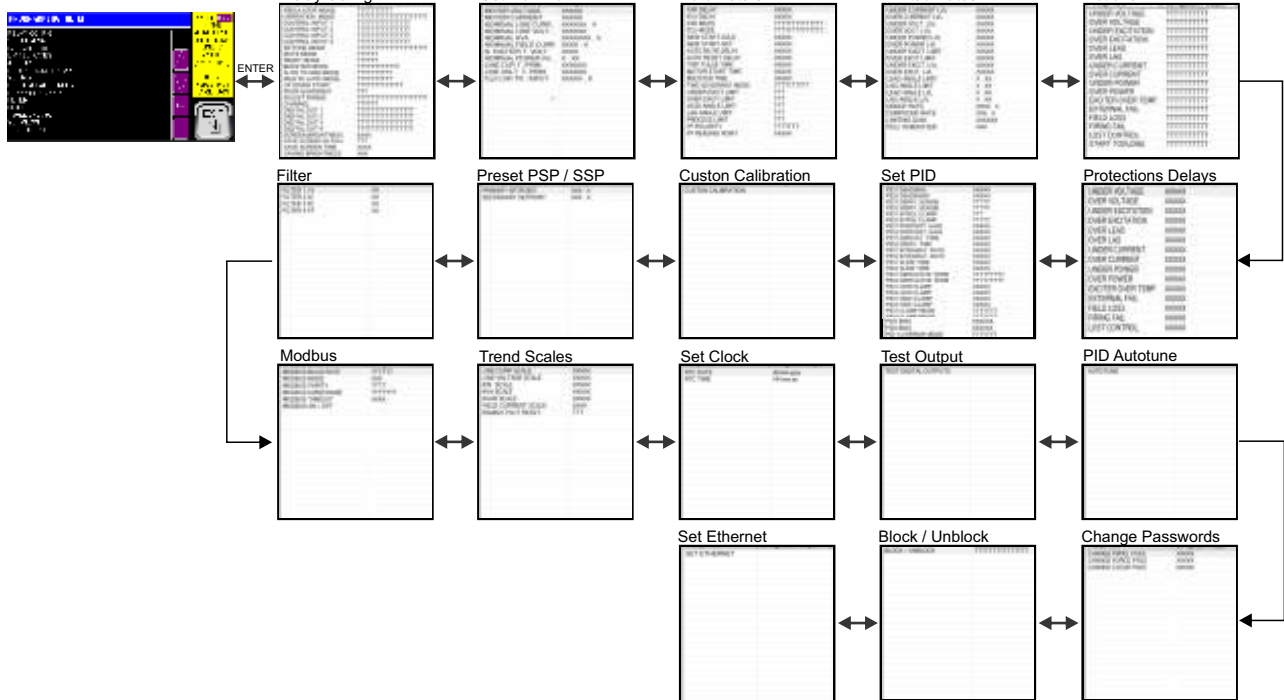
INFO SCREENS



MENU - ENTER

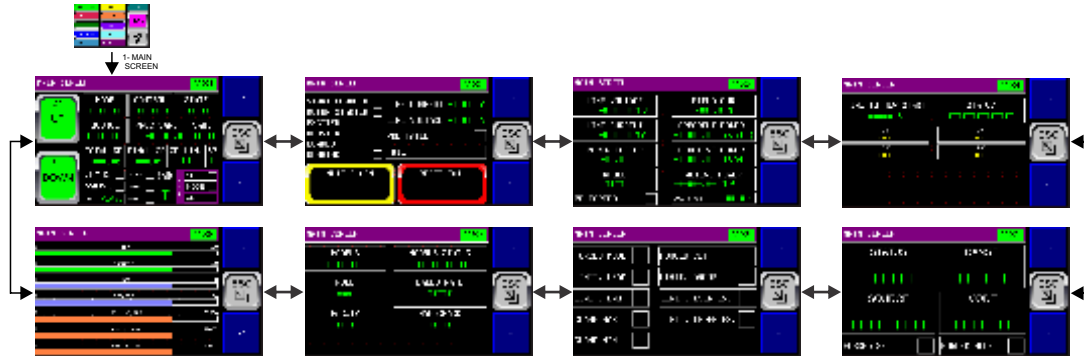


MENU



SCREEN FLOW

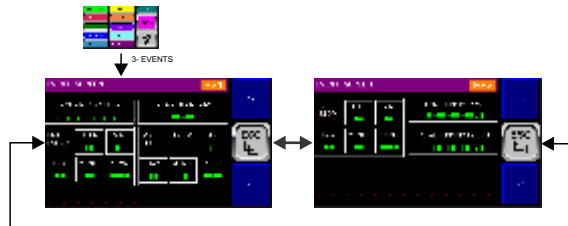
1- MAIN SCREEN



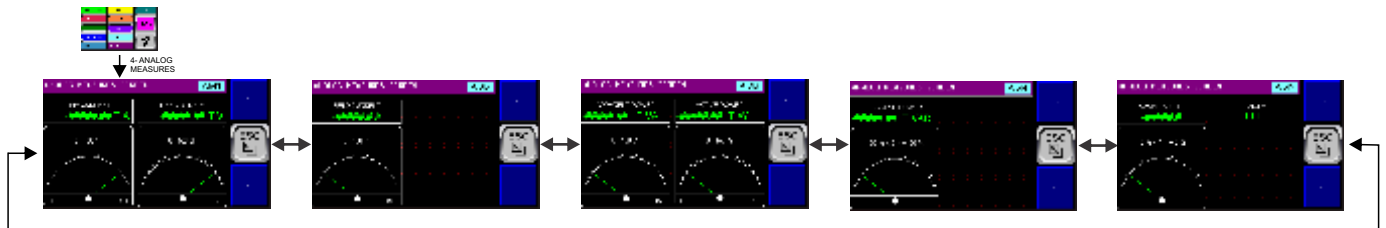
2- FAILS / INDICATOR



3- EVENTS

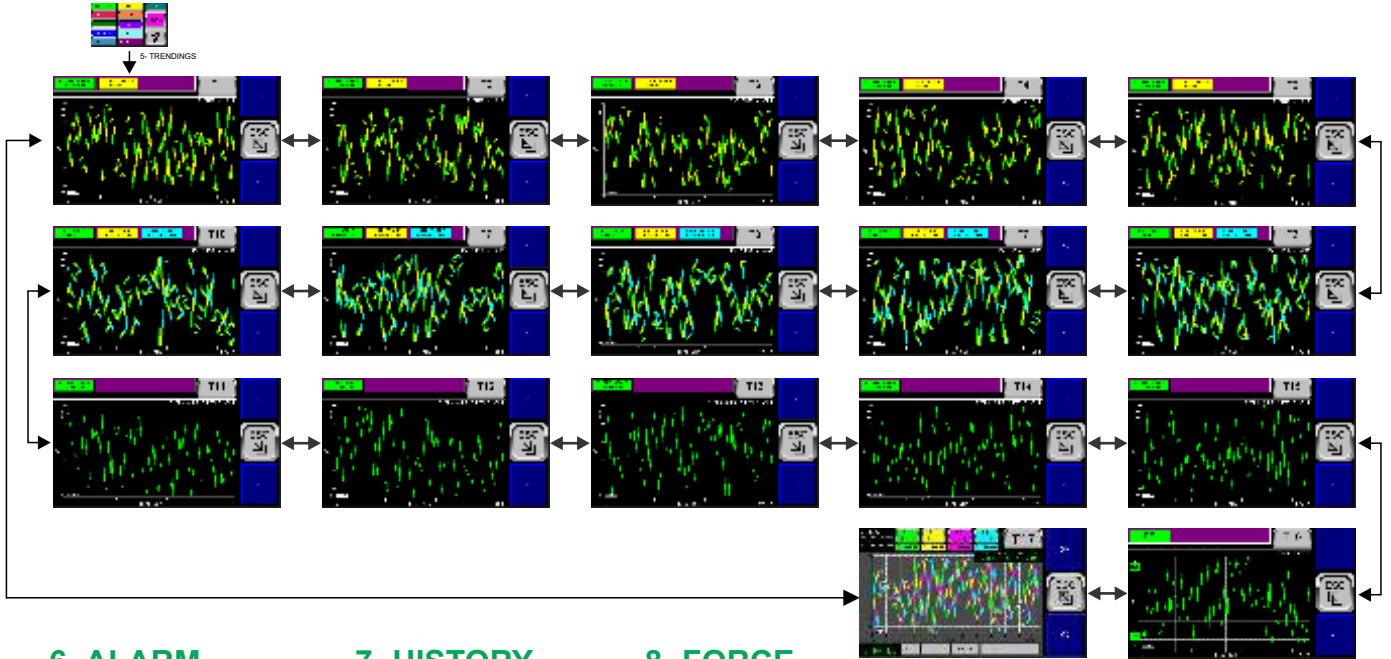


4- ANALOG MEASURES

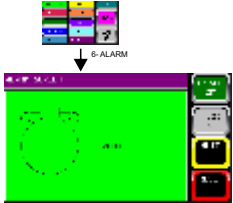


SCREEN FLOW

5- TRENDS



6- ALARM



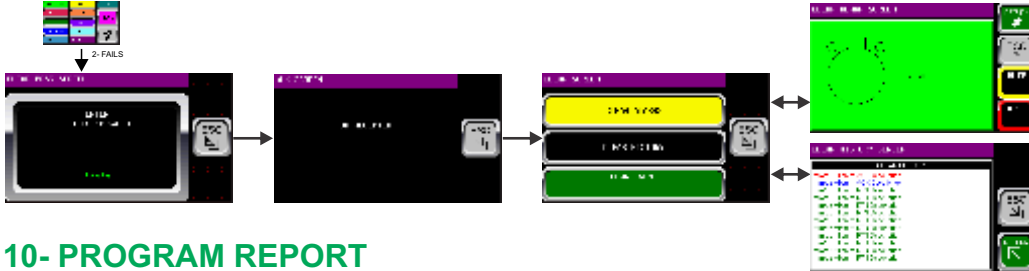
7- HISTORY



8- FORCE



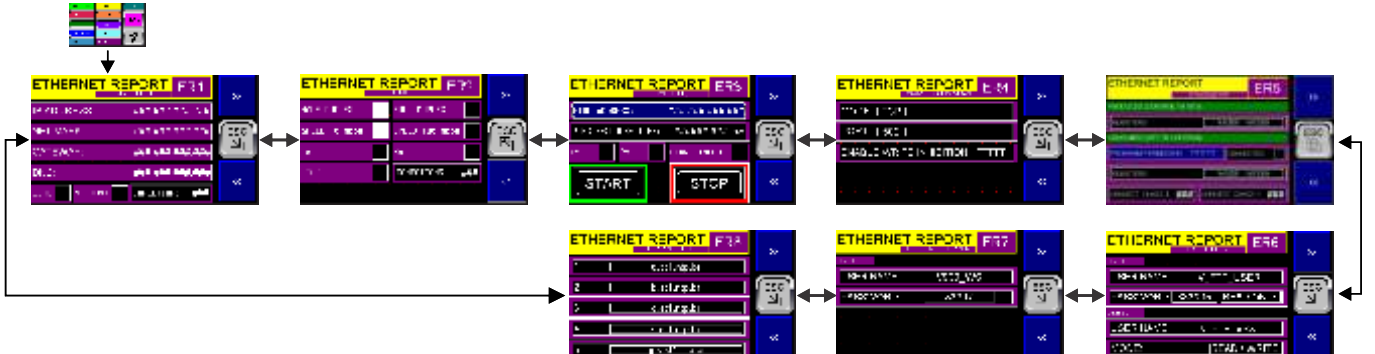
9- CLEAR



10- PROGRAM REPORT

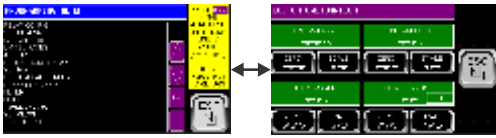


11- ETHERNET REPORT

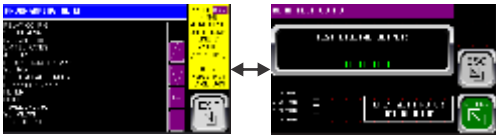


SCREEN FLOW

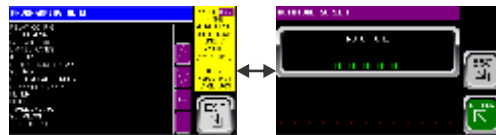
CUSTOM CALIBRATION



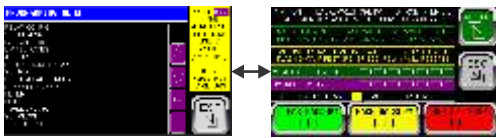
TEST DIGITAL OUTPUTS



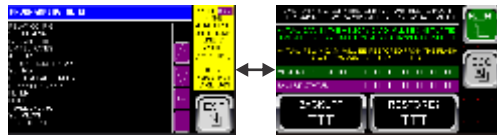
AUTOTUNE



FLASH BACKUP



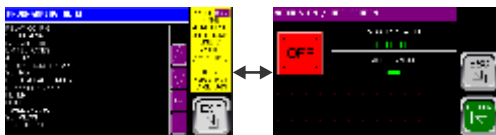
CLONE PARAMETERS



FACTORY CALIBRATION



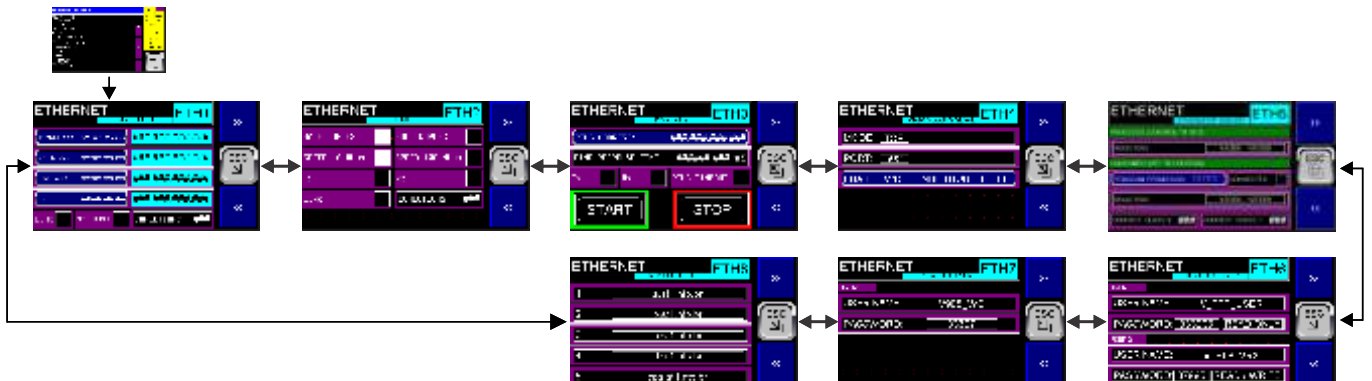
MODBUS ON / OFF



TIME TO MUTE / RESET SCREEN



ETHERNET PROGRAMMING



FAIL SAFE SYSTEM

The Fail Safe System is a feature that allows the VED905 V5L relay to continue operating in the event of certain types of "soft" faults. These "soft" faults include:

- Loss of backup battery power.
- Registry RAM corruption, or Firmware Flash corruption due to, for example, an excessive EMI event.

Attention: With the exception of the files inside the memory card directories, which can be freely altered or deleted, the files in the root directories cannot be modified or deleted under penalty of interrupting the relay operation.

The failsafe system encompasses the following features:

- Manually back up current registry settings from battery-backed RAM to Flash memory.
- Manually restore registry settings from values previously saved in Flash to battery-powered RAM.
- Detect corrupted registry settings at startup and then automatically restore them from Flash memory.
- Detect corrupted or empty Firmware in Flash memory at startup and then automatically load the AUTOLOAD.PGM file from removable media (Compact Flash or microSD).
- If an automatic registry restore or application load occurs, the VED905 V5L will automatically be put into RUN mode.

The fail-safe system can optionally be supplied ready-made and configured by Varixx.

WARNING: The Fail Safe system allows to resume, on an emergency basis, the excitation system operation in case of memory failure, for posterior checking and maintenance of the relay, avoiding long stops of the system. If the fault occurs when the system is operating, the system will not prevent the system from stopping due to the activation of external protections of the synchronous motor.

MODBUS

A complete explanation of the Modbus RTU or ASCII protocol is not within the scope of this manual. It is assumed that the user who is going to apply the same using this protocol, must have sufficient knowledge for this.

If you want more information, you can consult Varixx Bulletin 260BE, about the older model VED905B, where there is a whole theoretical explanation, although the memory map is totally different and cannot be considered for this model.

Also, in this manual we will only provide the basic addresses of the memory map to perform the usual operations of reading faults and others, without allowing parameter programming via Modbus, for safety reasons. Any programming of parameters must be performed on the equipment itself, as it is normally done only once, during Startup.

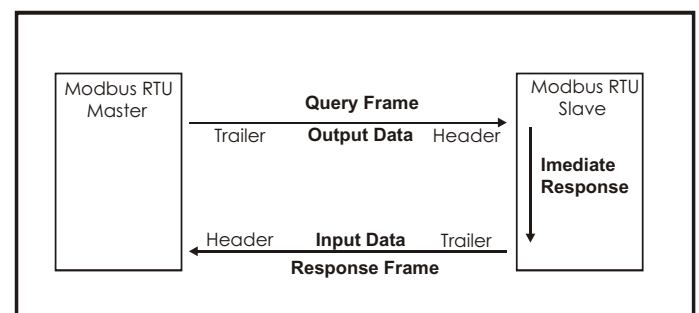
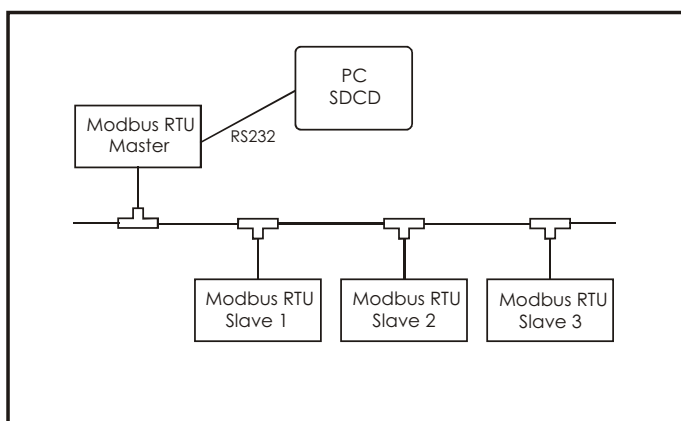
Next there will be a small introduction to the Modbus communication network before the presentation of the memory map.

All the following texts will be in English as technical terms are used extensively in English and are not worth the complete translation.

Devices communicate using a master-slave technique, in which only one device (the master) can initiate transactions (called 'queries'). The other devices (the slaves) respond by supplying the requested data to the master, or by taking the action requested in the query. Typical master devices include host processors and programming panels. Typical slaves include programmable controllers, motor controllers, load monitors etc, see Fig

The master can address individual slaves. Slaves return a message (called a 'response') to queries that are addressed to them individually.

The Modbus protocol establishes the format for the master's query by placing into it the device address, a function code defining the requested action, any data to be sent, and an error checking field. The slave's response message is also constructed using Modbus protocol. It contains fields confirming the action taken, any data to be returned and an error-checking field. If an error occurred in receiving the message, or if the slave is unable to perform the requested action, the slave will construct an error message and send this as its response, see Fig.



MODBUS

Address field

The address field of a message frame contains eight bits. The individual slave devices are assigned addresses in the range of 1 - 247. A master addresses a slave by placing the slave address in the address field of the message.

When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding.

Function field

The function code field of a message frame contains eight bits. Valid codes are in the range of 1 - 6, 15, 16 and 23. When a message is sent from a master to a slave device, the function code field tells the slave what kind of action to perform.

Examples are:

- to read the ON/OFF states of a group of inputs;
- to read the data contents of a group of parameters;
- to read the diagnostic status of the slave;
- to write to designated coils or registers within the slave.

When the slave responds to the master, it uses the function code field to indicate either a normal (error-free) response or that some kind of error occurred (called an exception response). For a normal response, the slave simply echoes the original function code. For an exception response, the slave returns a code that is equivalent to the original function code with its most significant bit set to a logic 1.

In addition to its modification of the function code for an exception response, the slave places an unique code into the data field of the response message. This tells the master what kind of error occurred, or the reason for the exception.

The master device's application program has the responsibility of handling exception responses. Typical processes are to post subsequent retries of the message, to try diagnostic messages to the slave and to notify operators. Additional information about function codes and exceptions comes later.

Data field

The data field is constructed using sets of two hexadecimal digits (8 bits), in the range of 00 to FF hexadecimal.

The data field of messages sent from a master to slave devices contains additional information which the slave must use to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be

handled and the count of actual data bytes in the field.

For example, if the master requests a slave to read a group of holding registers (function code 03), the data field specifies the starting register and how many registers are to be read. If the master writes to a group of registers in the slave (function code 10 hexadecimal), the data field specifies the starting register, how many registers to write, the count of data bytes to follow in the data field, and the data to be written into the registers.

If no error occurs, the data field of a response from a slave to a master contains the data requested. If an error occurs, the field contains an exception code that the master application can use to determine the next action to be taken.

CRC Error checking field

The error checking field contains a 16 bit value implemented as 2 bytes. The error check value is the result of a Cyclical Redundancy Check (CRC) calculation performed on the message contents.

The CRC field is appended to the message as the last field in the message. When this is done, the low-order byte of the field is appended first, followed by the high-order byte. The CRC high-order byte is the last byte to be sent in the message. Additional information about CRC calculation are found in this manual.

MODBUS

Functions

Standard MODBUS function codes.

Function name	Function code
Read Coil (Bit) Status	1 (01h)
Read Input Status	2 (02h)
Read Holding Registers	3 (03h)
Read Input Registers	4 (04h)
Force Single Coil (Bit)	5 (05h)
Force Single Register	6 (06h)
Force Multiple Coils (Bits)	15 (0Fh)
Force Multiple Registers	16 (10h)
Force/Read Multiple Holding Registers	23 (17h)

Read Input Status

Read the status of digital read-only information.

EXAMPLE : Request the digital input 2. Assuming that It is no active.

Status: Modbus no = 2.

Request message.

Field name	Hex value
Slave address	01
Function	02
Start address HI	00
Start address LO	02
Number of Inputs HI	00
Number of Inputs LO	01
CRC LO	18
CRC HI	0A

Response message.

Field name	Hex value
Slave address	01
Function	02
Byte count	01
Input no.2 (02h)status	00
CRC LO	A1
CRC HI	88

Read Holding Registers

Read the value of analogue changeable information.

Example, requesting some Voltage, Frequency and Current. Their values are 400.0 V, 60 Hz and 15.5 A.

400.0V, unit 0.1V - 4000 (0FA0h)

60Hz unit 1Hz - 60 (003Ch)

15.5A, unit 0.1A- 155 (009Bh)

Request message.

Field name	Hex value
Slave address	01
Function	0
Start address HI	00
Start address LO	00
Number of Registers HI	00
Number of Registers LO	03
CRC LO	05
CRC HI	CB

Response message

Field name	Hex value
Slave address	01
Function	03
Byte count	06
Reg no. 0, (0h) data HI	0F
Reg no. 0, (0h) data LO	A0
Reg no. 1, (1h) data HI	00
Reg no. 1, (1h) data LO	3C
Reg no. 2, (2h) data HI	00
Reg no. 2, (2h) data LO	9B
CRC LO	20
CRC HI	34

Read Coil Status

Read the status of digital changeable parameters.

EXAMPLE

Requesting the coil (Bit) 29 input state. Suppose it is On

30 input: Modbus no = 29 (1Dh)

On = Yes = 1 Coil = 0001

1 byte of data: Byte count=01

Request message.

Field name	Hex value
Slave address	01
Function	01
Start address HI	00
Start address LO	1D
Number of Coils HI	00
Number of Coils LO	01
CRC LO	6D
CRC HI	CC

Response message.

Field name	Hex value
Slave address	01
Function	01
Byte count	01
Coil no.29 (1Dh) status	01
CRC LO	90
CRC HI	48

MODBUS

Read Input Registers

Read the contents of analogue read-only information.

EXAMPLE

Request the value of the 30011 Modbus - N° 10. Suppose It is 452.0.

It has a long representation. 2 registers are used (30011 high word and 30012 low word)

452.0, unit 0.1 - 4520 (000011A8h).

Request message.

Field name	Hex value
Slave address	01
Function	04
Start address HI	00
Start address LO	0A
Number of Registers HI	00
Number of Registers LO	02
CRC LO	51
CRC HI	C9

Response message.

Field name	Hex value
Slave address	01
Function	04
Byte count	04
Reg no. 10 (0Ah) data HI	00
Reg no. 10 (0Ah) data LO	00
Reg no. 11 (0Bh) data HI	11
Reg no. 11 (0Bh) data LO	A8
CRC LO	F6
CRC HI	6A

Force Single Coil (Bit)

Set the status of one changeable digital parameter.

EXAMPLE

Set one command to ON. This will cause the some kind of action.

Modbus no = 1 - address LO 1 (01h)

Run = 1 - 0 Data HI = 255 (0FFh), Data LO = 00 (00h)

Request message.

Field name	Hex value
Slave address	01
Function	05
Start address HI	00
Start address LO	01
Data HI	FF
Data LO	00
CRC LO	DD
CRC HI	FA

Response message.

Field name	Hex value
Slave address	01
Function	05
Start address HI	00
Start address LO	01
Data HI	FF
Data LO	00
CRC LO	DD
CRC HI	FA

MODBUS

Force Multiple Coil

Set the status of multiple digital changeable parameters.

EXAMPLE

Set one flag to ON and other to ON. This will cause some actions or change parameters. Coil no. = 0-1 Reset -> 1 // Run = 1 -> 00000011 (03h)

Request message.

Field name	Hex value
Slave address	01
Function	0F
Start address HI	00
Start address LO	00
Number of Coils HI	00
Number of Coils LO	02
Byte count	01
Coil no. 0-1 status (0000 0011B)	03
CRC LO	9E
CRC HI	96

Response message.

Field name	Hex value
Slave address	01
Function	0F
Start address HI	00
Start address LO	00
Number of Coils HI	00
Number of Coils LO	02
CRC LO	D4
CRC HI	0A

Force Multiple Register

Set the contents of multiple changeable analogue param.

EXAMPLE

Set the register 40018 (Modbus N° 17) to 25.0 (250 / 10) and 40019 (Modbus N° 18) to 55. 25.0, unit 0.1 -> -250 (00FAh) // 55, unit 1% -> 55 (0037h)

Request message.

Field name	Hex value
Slave address	01
Function	10
Start address HI	00
Start address LO	11
Number of Registers HI	00
Number of Registers LO	02
Byte count	04
Data HI reg 17 (11h)	00
Data LO reg 17 (11h)	FA
Data HI reg 18 (12h)	00
Data LO reg 18 (12h)	37
CRC LO	52
CRC HI	88

Response message.

Field name	Hex value
Slave address	01
Function	10
Start address HI	00
Start address LO	11
Number of Registers HI	00
Number of Registers LO	02
CRC LO	11
CRC HI	CD

Force/Read Multiple Register

Set and read the contents of multiple analogue changeable parameters in the same message.

EXAMPLE

Set one parameter to 2 (40022 = Modbus N° 21) and other to 1 (40023 = Modbus N° 22) and read others two. They are 1450 and 17000.

1450, unit 1 -> 1450 (05AAh)
17000, unit 1 -> 17000 (4268h)

Request message.

Field name	Hex value
Slave address	01
Function	17
Start read address HI	00
Start read address LO	03
Number of read Regs HI	00
Number of read Regs LO	02
Start write address HI	00
Start write address LO	15
Number of write Regs HI	00
Number of write Regs LO	02
Byte count	04
Data HI Reg 21 (15h)	00
Data LO Reg 21 (15h)	02
Data HI Reg 22 (16h)	00
Data LO Reg 22 (16h)	01
CRC LO	62
CRC HI	77

Response message.

Field name	Hex value
Slave address	01
Function	17
Byte count	04
Reg no. 3, (3h) data HI	05
Reg no. 3, (3h) data LO	AA
Reg no. 4, (4h) data HI	42
Reg no. 4, (4h) data LO	68
CRC LO	E8
CRC HI	85

Exception response message.

Field name	Hex value
Slave address	01
Function	84
Exception code	02
CRC LO	C2
CRC HI	C1

Exception codes.

Exc. code	Name	Description
01	Illegal function	This unit doesn't support the function code.
02	Illegal data address	The data address is not within its boundaries.
03	Illegal data value	The data value is not within its boundaries.
06	Busy	The unit is unable to perform the request at this time. Retry later.

MODBUS

PORTA DE COMUNICAÇÃO RS232C:
STANDARD 9 PINOS (DB9). OPTIONALLY VARIXX
CAN SUPPLY A RS232C TO RS485 CONVERTER
MODULE.

In case of use a RS232 / RS485 Converter:

ARS485 is adequate to a multi-droop network. In the multi-droop Modbus network is necessary a termination with resistors in the last slave unit of the network cable at two or 4 wires.

These resistors increases the noise immunity and its non placement commits the reliability. The connection cables of the network should be of good quality and shielded with the shield must be connected to the ground in just one point. In networks using two wires cable in short distances it is acceptable use of twisted pair's use.

There are two board versions: one of them with DIP switches to close the termination resistors and the other without DIP switches or resistors. In the version without the termination resistors is the user's responsibility the placement of the resistors directly in the connector cable of the last slave device of the network.

The value of these resistors must have a adequate ohm value and it should be connected among the lines A / Ground and B / Ground.

Using Modbus Slave Communications

Overview:

The VED905 V5L allow the serial port to act as a Modbus/RTU slave. The Modbus function supports both ASCII and RTU modes (RTU configured by factory, ASCII under request) of operation across a range of baud rates and protocol frames. Also supported is port activity status, an in-activity timer and support for call-on-exception operation.

Basic Operation:

Before the Modbus function accepts messages, the Modbus must be activated pressing F5 (keyboard) for more than 3 seconds (Toggle).

Inactivity Timer:

The Modbus function contains a timer that is reset on the reception of a valid message addressed to this function. Should communications cease between the master and this function, that timer expires which sets an Inactivity timeout bit in the status word. Once communications is reestablished, both the timer and the Inactivity timeout bit in the status word are reset. Setting the timeout value to zero (at menu 13) disables this feature.

Report-on-exception:

Report-on-exception is a method of immediately informing the master that the slave has important information pending. This method is typically used in applications where modems are used as the communication channel, and the slaves are polled for data between long intervals. Once the connection is established, the master and slave

require some cooperative functionality on determining the address of the slave calling. Since this functionality is not a standardized or a part of the Modbus protocol, the Modbus function contains two alternate methods such that the one most appropriate for the master is selected.

The first method involves the slave responding to the non-standard Modbus request Get Slave Address, which is broadcasted by the master after the connection is established. Since this is just a response to a Modbus request, this method does not require that Exception Messaging be enabled. This is method used by VED905. Use of this method with a third party master can require that master to be modified to support this command. The Modbus request and response frames are presented below:

Request:

ADDR	FUNC
0	65(41H)

Response:

ADDR	FUNC	DATA
(SLAVE ADDR)65(41H)		(SLAVE ADDR)

The second method involves the slave sending an unsolicited response (Exception Message) to the master once the connection is established (available only by request). The specific byte pattern used for the Exception Message depends on that supported by the master. When sent, the appropriate header and checksums are inserted automatically by the Modbus function. The Byte Count acts as the trigger that starts the transmission of the response. When the Byte Count transitions from zero to a specific number, that number of bytes are sent. Once transmitted, the Modbus function responds to master requests as expected.

Master Mapping:

To access a memory point or memory flag over Modbus, the master must be configured as to the point's type and offset. This is usually accomplished with one of two methods. The first method uses the traditional addressing scheme where the high digit represents the point's type and the lower digits represent the point's offset (starting with point 1). Since only four types can be represented in this manner, the Modbus function packs several data tables into a single point type array.

The Traditional RTU Reference column below specifies the starting address of each table. The second method requires the master to be configured with the specific Modbus command and offset. The supported Modbus commands and the associated offset are also illustrated below.

MODBUS

How to Connect a MODBUS slave device.

The physical device characteristics of the particular slave device determines the communications parameters required for connection. MODBUS is a multidrop communications protocol, (software), but typical RS-232 serial connections are not. RS-232 is basically a point-to-point hardware protocol with the transmit line of one device connected to the receive line of another device. Various combinations of protocol converters and/or modems may be used to multidrop RS-232 data links. Additionally, some serial cards may be configured to support 20 mA current loop for multidrop operation.

If a single slave device is to be connected, standard RS-232 hardware may be used. Depending upon the requirements of the master device, certain control signals may be required. These are typically RTS/CTS, (pins 4&5), or DTR/DSR/DCD, (pins 6,8 & 20). The VED905 supports these control signals.

Comm Port Buffering

The VED905 firmware maintains a Transmit Buffer and a Receive Buffer. When a Send or Receive task is performed, data is transferred between the appropriate buffer and the program's registers.

For a Comm Port Transmit element, the TX Count word contains the number of characters moved from the program registers to the transmit buffer. This number can be less than the requested number if the comm port buffer is full.

For a Comm Port Receive element, the RX Count word contains the number of characters moved from the receive buffer in the program area. This number can be less than the requested number if the comm port buffer contains fewer characters than requested.

Serial Port

The serial port physically present on the VED905 unit is referred to as COMM1.

Handshaking

Handshaking is a method whereby the destination end of a transmission can control how much and when data is sent to it.

NOTE: For purposes of this discussion, source end is

defined as the unit which is transmitting data. Destination end is defined as the unit which actually receives the data.

Handshaking is configured on VED905 V5L menu. There are five (5) possible types of handshaking:

NONE -- There is no handshaking. The source unit sends as many data bytes as it can as fast as possible for a given baud rate. No consideration is given to the capabilities of the destination end.

XON/XOFF -- (Also called software handshaking) The destination end keeps track of how many characters it has received and the size of its internal buffers. If the buffer gets full or the unit is otherwise unable to receive further characters, it must transmit the XOFF (transmit off) character. The source end must then stop transmitting data until a subsequent XON character is sent by the destination end.

Because there is some heavy software overhead involved, the timing of transmissions is variable. The destination must first determine that it is full and then transmit the XOFF signal. The source end must read the XOFF signal and react to it. In the mean time, several additional data bytes can be sent. It is up to the destination end to ensure that it sends the XOFF signal soon enough that the buffer is not overrun.

The XON and XOFF characters are predefined by the ASCII character set. XON is 11 hex or 17 decimal. XOFF is 13 hex or 19 decimal. The XON/XOFF handshaking is most often used where only ASCII values are being sent. XON/XOFF can not be easily used where binary data is involved, because the XON/XOFF codes are also valid binary codes.

Note that XON/XOFF handshaking usually implies a full duplex (both ends may transmit simultaneously) communications channel as the destination end needs to transmit the XOFF characters at any time (including in the middle of a transmission from the source end).

The advantage to XON/XOFF handshaking is that it can be implemented using an easy and cheap three-wire (TX/RX/Common) cable.

HARDWARE -- Also called RTS/CTS handshaking. Hardware handshaking requires extra signals be sent between the two units, thus this is more expensive to implement due to the increased numbers of wires in the interconnecting cables.

In operation, the destination end determines that it is empty, and activates its CTS (Clear To Send) signal. In response,

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the source end sends data so long as the CTS signal remains active.

Many devices have the RTS/CTS signals wired directly into the hardware. Thus, an inactive CTS signals from the destination end can instantly shut down the source end. These hardware operations can be very fast because no software control is necessary in this case. Also, this manner of handshaking can be used regardless of the nature of the data being transmitted, ASCII coded or binary.

Multi-Drop Full Duplex -- In a full-duplex multi-drop situation, all available units are wired in parallel. For receiver circuitry this is no problem so long as the load on the network is not excessive. All units have their receivers enabled at all times.

Each message sent through the system is somehow identified by giving it a drop address. All units will receive all messages. All units check the drop address against their own address, and only the unit with the matching address responds.

When a unit determines that it has something to transmit it turns on its transmitter, sends the necessary data packet, and then disables its transmitter.

Full Duplex Multi-drop is usually found in multi-master or peer to peer systems, where all units have a more or less equal chance of needing to transmit a message. Often, the units needs to verify that the message they sent are sent correctly so the receiver is left on at all times.

The advantage to this system is that many units can be connected to a simple three-wire (RX/RX/Common) cable. The drawback to this system is increased firmware and software complexity.

Multi-Drop Half Duplex -- Multi-Drop Half-Duplex operation is identical to Full-Duplex except that the transmitting unit's receiver is disabled when the unit is transmitting.

All units maintain their transmitters disabled and receivers enabled at all times except when they need to transmit. Usually, protocols dictate that only the unit matching the drop address can transmit. This unit turns on its transmitter, turns off its receiver, sends the necessary data packet, and then disables its transmitter and enables its receiver.

Half Duplex Multi-drop is usually found in Master/Slave systems where one unit is designated a Master and all other units are Slaves. The Master transmits a message to one Slave, and then disable it's transmitter. All Slaves hear the message, but only the Slave with the matching "drop address" will turn on its transmitter and respond.

Using RS-485 with the VED905

The VED905 does not provide RS-485 compatible signals. It is necessary to purchase and install a third-party RS-232 to RS-485 converter.

In this mode, transmitter control is VED905 Signal CTS, available on the DB-9 connector, Pin 8. When the VED905 asserts this signal, the converter enables its transmitting section.

Data Types

In VED905 V5L, data may be stored or used in a variety of different formats. The format used depends on how the information is to be interpreted. Typical interpretations are binary bit patterns, unsigned numbers, signed numbers, floating point values, and strings.

Type Name Description

BOOL Boolean: A single bit. It can contain only the values '0' or '1'.

BYTE Byte: A string of 8 consecutive bits. Byte values are used where the value of the data is not as important as the bit patterns (shifts and rotates).

WORD Word A string of 16 consecutive bits. Word values are used where the value of the data is not as important as the bit patterns (shifts and rotates).

DWORD: Double Word A string of 32 consecutive bits. DWORD values are used where the value of the data is not as important as the bit patterns (shifts and rotates).

INT Integer A 16-bit signed value. Integers are used where the value of the data is expected to be in the range of -32,768 to +32,767

SINT: Short Integer An 8-bit signed value. Short Integers are used where the value of the data is expected to be in the range of -128 to +127.

DINT: Double Integer A 32-bit signed value. Double Integers are used where the value of the data is expected to be in the range of -2,147,483,648 to +2,147,483,647.

UINT: Unsigned Integer A 16-bit unsigned value. Unsigned Integers are used where the value of the data is expected to be in the range of -0 (zero) to 65,535.

USINT: Unsigned Short Integer An 8-bit unsigned value. Unsigned Short Integers are used where the value of the data is expected to be in the range of 0 (zero) to 255

UDINT: Unsigned Double Integer A 32-bit unsigned value. Unsigned Double Integers are used where the value of the data is expected to be in the range of 0 (zero) to 4,294,967,296.

REAL Floating Point: A 32-bit value. Values are stored and operated on in IEEE single precision (six digit) format. Values range from -3.40282E+38 to +3.40282E+38.

STRING: String A variable-length succession of characters. Each character is represented by one byte.

The bits in word registers may be used as Boolean values. In this case, Bit Offset Addressing is used to specify the Register Type, Offset, and Bit Offset for the required bit. Using Boolean registers to represent Real numbers is usually ineffective.

STORAGE ORDER

32-bit values (DWORD, DINT, UDINT) occupy 32 consecutive bits of data, or two (2 consecutive 16-bit registers. For example, if a DINT is defined at Register %R43, the 32-bit value is contained in %R43 and %R44.

For 32-bit values, data is stored Low Order Word first. For example, if a DINT is defined at Register %R43 and contains the value "65540", (0000000000000001 000000000000100) register %R43 will contain "4" and %R44 will contain "1".

Byte values (such as STRINGS) are stored High Order Byte first. For example, to store the string "31" in register %R43, store the HEX value 3133 (decimal 12595).

Register Types]

Controllers offer a wide variety of Register Types. In most cases, the controller treats register types as if they were memory locations.

The following is a list of register types implemented in the VED905 and available for user's.

%AI Analog Input

16-bit input registers used to gather analog input data such as voltages, temperatures, and speed settings coming from an attached device.

%AQ Analog Output

16-bit output registers used to send analog information such a voltages, levels or speed settings to an attached device.

%I Digital Input

Single-bit input registers. Typically, an external switch is connected to the registers.

%K Key Bit

Single-bit flags used to give the programmer direct access to any front panel keys appearing on a unit. Only the OCS series has keypads.

%Q Digital Output

Single-bit output registers. Typically, these bits are connected to an actuator, indicator light or alarm annunciator.

%R General Purpose Register

Retentive 16-bit registers.

%S System Bit

Single-bit bit coils predefined for system use.

%SR System Register

16-bit registers predefined for system use.

%T Temporary Bit

Non-retentive single-bit registers.

Bit-Mapped Addressing of 32-bit Registers

Bit-mapped addressing of 32-bit registers is not allowed. Bit offset values range from 1 to 16.

In order to access all 32 bits in a double register it is necessary to address the upper word of the register separately. Storage is such that the lower word is stored in the first (base) register, and the upper word is stored in the next consecutive register.

For example. if the 32-bit binary 0000000000000001 0000000000000100 value (65540 decimal) is loaded into register %R43, %R43 contains 0000000000000100 and %R44 contains 0000000000000001. Therefore, to check Bit 17 of the DWORD stored at %R43, one must check Bit 1 of %R44, addressed as %R44.1.

Numbering Base

In VED905 all offsets begin with 1 (one). 0 (zero) is not valid for register offset nor bit offset addressing.

Register offsets are thus in the range of 1 to X, where X is the maximum number of register in this model. For example, if the selected type has 2048 %R registers, they are addressed as %R01 through %R2048.

Bit Offsets are in the range of 1 to 16.

Groups of Boolean registers can be accessed as a 16-bit register. In this case, though, the Bit offset must lie on a 16-bit boundary, 1, 17, 33, etc.

READ OUTPUT STATUS (FUNCTION CODE 01)

This function allows the user to obtain the ON/OFF status of logic coils used to control discrete outputs from the addressed slave. In addition to the slave address and function fields, the message requires that the information field contain the initial coil address to be read, (Starting Address), and the number of locations that will be interrogated to obtain status data.

The following is an example of a message to Read Output Status Coils 20-56 from slave device number 17.

```
ADDR / FUNC / DATA START PT HO / DATA START PT LO / DATA # OF PTS HO / DATA # OF PTS LO / ERROR CHECK FIELD
11      01      00                13                00                25                B6
```

An example response to Read Output Status is shown below. The data is packed one bit for each coil. The response includes the slave address, function code, quantity of data characters, and error checking. Data will be packed with one bit with one bit for each coil, (1 = ON, 0 = OFF). The low order bit of the first character contains the addressed coil, and the remainder follow. For coil quantities that are not even multiples of eight, the last characters will be filled in with zeroes at the high end. The quantity of data characters is always specified as the quantity of RTU characters, i.e., the number is the same whether RTU or ASCII is used.

```
ADDR / FUNC / BYTE COUNT / DATA COIL STATUS20-27 / DATA COIL STATUS28-35
11      01      05          CD                      6B
```

```
DATA COIL STAT.36-43 / DATA COIL STAT.44-51 / DATA COIL STAT.52-56 / ERROR CHECK FIELD
B2                0E                1B                D6
```

The status of coils 20-27 is shown as CD(HEX) = 1100 1101(Binary). Reading left to right, this shows that coils 27,26,23,22, and 20 are all on. The other coil data bytes are decoded similarly.

READ INPUT REGISTERS (FUNCTION CODE 04)

Function Code 04 obtains the contents of the controllers input registers. These locations receive their values from devices connected to the I/O structure and can only be referenced, not altered from within the controller nor via MODBUS. The example below requests the contents of register 30009 in slave number 17.

ADDR / FUNC / DATA START PT HO / DATA START PT LO / DATA # OF REGS HO / DATA # OF REGS LO / ERROR CHECK FIELD
 11 04 00 08 00 01 E2

In the response message, the contents of register 30009 is decimal value 0.

ADDR / FUNC / BYTE COUNT / DATA INPUT REG HO 30009 / DATA INPUT REG LO 30009 / ERROR CHECK FIELD
 11 04 02 00 00 E9

FORCE SINGLE COIL (FUNCTION CODE 05)

This message forces a single coil either On or OFF. Any coil that exists within the controller can be forced to either state, (ON or OFF). Coils are numbered from zero (i.e. coil 1 is address 0000, coil 2 is address 0001, etc.). The data value 65,280, (FF00 HEX) will set the coil ON and the value zero will turn it off. All other values are illegal and will not effect the coil. The use of slave address 00, (Broadcast mode), will force all attached slaves to modify the desired coil. The example below requests slave number 17 to turn coil number 0173 ON.

ADDR / FUNC / DATA COILHO / DATA COILLO / DATA # ON/OFF / DATA / ERROR CHECK FIELD
 11 05 00 AC FF 00 3F

The normal response to the command request is to retransmit the message as received, after the coil state has been altered.

ADDR / FUNC / DATA COILHO / DATA COILLO / DATA # ON/OFF / DATA / ERROR CHECK FIELD
 11 05 00 AC FF 00 3F

PRESET SINGLE REGISTER (FUNCTION CODE 06)

Function 06 allows the user to modify the contents of a holding register. Any holding register that exists within the controller can have its contents changed by this message. The values are provided in binary up to the maximum capacity of the controller. Unused high-order bits must be set to zero. When used with slave address 00, all slave controllers will load the specified register with the contents specified.

ADDR / FUNC / DATA REGHO / DATA REGLO / DATA VALUEHO / DATAVALUE LO / ERROR CHECK FIELD
 11 06 00 87 03 9E C1

The normal response to a preset single register request is to retransmit the query message after the register has been altered.

ADDR / FUNC / DATA REGHO / DATA REGLO / DATA VALUEHO / DATAVALUE LO / ERROR CHECK FIELD
 11 06 00 87 03 9E C1

READ INPUT STATUS (FUNCTION CODE 02)

This function allows the user to obtain the ON/OFF status of discrete inputs in the addressed slave. In addition to the slave address and function code fields, this message requires that the information field contain the initial input address to be read, (Starting Address) and the number of locations that will be interrogated to obtain the status data.

The following is an example of a message to Read Input Status Coils 10197-10218 from slave device number 17.

```
ADDR / FUNC / DATA START PT HO / DATA START PT LO / DATA # OF PTS HO / DATA # OF PTS LO / ERROR CHECK FIELD
11      02      00                C4                00                16                13
```

An example response to Read Input Status is shown below. The data is packed one bit for each coil. The response includes the slave address, function code, quantity of data characters, and error checking. Data will be packed with one bit with one bit for each coil, (1 = ON, 0 = OFF). The low order bit of the first character contains the addressed coil, and the remainder follow. For coil quantities that are not even multiples of eight, the last characters will be filled in with zeroes at the high end. The quantity of data characters is always specified as the quantity of RTU characters, i.e., the number is the same whether RTU or ASCII is used.

```
ADDR / FUNC / BYTE COUNT / DATA DISCRETE INPUT10197-10204 / DATA DISCRETE INPUT10205-10212
11      02      03                AC                DB
```

```
DATA DISCRETE INPUT10213-10218 / ERROR CHECK FIELD
35                2E                LRC
```

The status of inputs 10197-10204 is shown as AC (HEX) = 1010 1100 (Binary). Reading left to right, this shows that inputs 10204, 10202, 10200 and 10099 are all on. The other input data bytes are decoded similarly.

READ OUTPUT REGISTERS (FUNCTION CODE 03)

Read Output Registers allows the user to obtain the binary contents of holding registers in the addressed slave.

These registers can store the numerical values of associated timers and counters which can be driven to external devices.

The following example reads registers 40108 through 40110 from slave number 17.

```
ADDR / FUNC / DATA START PT HO / DATA START PT LO / DATA # OF REGS HO / DATA # OF REGS LO / ERROR CHECK FIELD
11      03      00                6B                00                03                7E
```

The addresses slave responds with its address and the function code, followed by the information field. The information field contains 2 bytes describing the quantity of data bytes to be returned. The contents of the registers requested (DATA), are two bytes each, with the binary content right justified within each pair of characters. The first byte includes the high order bits and the second, low order bits.

In the example below, the registers 40108-40110 have the decimal contents 555, 0, and 100 respectively.

```
ADDR / FUNC / BYTE COUNT / DATA OUTPUTREGH.O.40108 / DATA OUTPUTREGL.O.40108
11      03      06                02                2B
```

```
DATA OUTPUTREGH.O.40109 / DATA OUTPUTREGL.O.40109 / DATA OUTPUTREGH.O.40110
00                00                00
```

```
DATA OUTPUTREGL.O.40110 / ERROR CHECK FIELD
64                55
```

MODBUS

MEMORY MAP FOR SERIAL AND ETHERNET TCP/IP AND HTTP COMMUNICATION

DIGITAL INPUTS

%I1	1 Bit	Read Only
%I2	1 Bit	Read Only
%I3	1 Bit	Read Only
%I4	1 Bit	Read Only

DIGITAL OUTPUTS

%Q1	1 Bit	Read Only
%Q2	1 Bit	Read Only
%Q3	1 Bit	Read Only
%Q4	1 Bit	Read Only

M FLAGS (1 Bit - Read / Write)

%M1	Under voltage Alarm
%M2	Over voltage Alarm
%M3	Reserved (Under Frequency)
%M4	Reserved (Over Frequency)
%M5	Under Excitation
%M6	Over excitation
%M7	Over lead
%M8	Over lag
%M9	Line Under current
%M10	Line Over current
%M11	Under Power
%M12	Over Power
%M13	Start Long
%M14	Over Temperature
%M15	External Fail
%M16	Field Loss
%M17	Lost of Control
%M18	Reserved (Field Temperature)
%M19	Field Short Circuit
%M20	Firing Fail
%M21	Last Event Normal Start
%M22	Last Event Normal Stop
%M42	Alarm Active
%M43	Trip Active
%M47	Fail Active
%M100	Mute Command
%M101	Reset Command

M FLAGS (1 Bit - Read Only)

%M401	Mode Automatic
%M402	Mode Manual O.Loop
%M403	Mode Manual Field Current
%M404	Mode Inhibit
%M405	Status Standby
%M406	Status Starting
%M407	Status Booster
%M408	Status Fail
%M409	Status Alarm
%M410	Status Excited
%M411	Status Loaded
%M412	Status Blocked
%M413	Setpoint Limiting None
%M414	Setpoint Limiting Low
%M415	Setpoint Limiting High
%M416	Setpoint Primary (P) active
%M417	Setpoint Secondary (S) Act.
%M418	Some Limiting Active
%M419	Pré Fail Active
%M420	Alarm Active
%M421	Trip Active
%M422	Fail Active
%M423	Process Limiting None
%M424	Process Limiting Low
%M425	Process Limiting High
%M426	Setpoint Forced
%M427	Mode Forced
%M428	Any Force Active
%M429	Start Permission OK
%M430	Starting
%M431	FAR OK
%M432	Booster Active
%M433	FCX OK
%M434	Running
%M435	Pre-Fail Active
%M436	Fail Active
%M437	P.F.Forced (Under Min.Load)
%M438	Protection Status Normal
%M439	Protection Status Alarm
%M440	Protection Status Fail
%M441	Protection Status Muted
%M442	Limiting Lag
%M443	Limiting Lead
%M444	Limiting Over Excitation
%M445	Limiting Under Excitation
%M446	Reserved (Lim. Frequency)
%M447	Limiting Droop
%M448	Forcing Mode
%M449	Forcing Setting

%M450	Clamping Low Active
%M451	Clamping High Active
%M452	Under Voltage Fail Active
%M453	Over Voltage Fail Active
%M454	Reserved Under Frequency
%M455	Reserved Over Frequency
%M456	Under Excitation Fail Active
%M457	Over Excitation Fail Active
%M458	Lead Angle Fail Active
%M459	Lag Angle Fail Active
%M460	Line Under Current Fail Act.
%M461	Line Over Current Fail Act.
%M462	Under Power Fail Active
%M463	Over Power Fail Active
%M464	Start Long Fail Active
%M465	Over Temperature Fail Act.
%M466	External Fail Active
%M467	Field Loss Fail Active
%M468	Lost of Control Fail Active
%M469	Reserved (Field Over Temp)
%M470	Firing Fail Active
%M471	Digital Input 1
%M472	Digital Input 2
%M473	Digital Input 3
%M474	Digital Input 4
%M475	Reserved (Digital Input 5)
%M476	Reserved (Digital Input 6)
%M477	Reserved (Digital Input 7)
%M478	Reserved (Digital Input 8)
%M479	Reserved (Digital Input 9)
%M480	Reserved (Digital Input 10)
%M481	Reserved (Digital Input 11)
%M482	Reserved (Digital Input 12)
%M483	Digital Output 1
%M484	Digital Output 2
%M485	Digital Output 3
%M486	Digital Output 4
%M487	Reserved (Digital Output 5)
%M488	Reserved (Digital Output 6)
%M489	Reserved (Digital Output 7)
%M490	Reserved (Digital Output 8)
%M491	Reserved (Digital Output 9)
%M492	Reserved (Digital Output 10)
%M493	Reserved (Digital Output 11)
%M494	Reserved (Digital Output 12)
%M495	Modbus Active
%M496	Reserved Future Use
%M497	Reserved Future Use
%M498	Reserved Future Use
%M499	Reserved Future Use
%M470	Reserved Future Use

Since there are two systems in use depending on the device or software used, namely base 0 and base 1, must be subtracted or not "1" from the Modbus Address + Offset number for correct operation. Don't forget that Double Word Registers or Real Floating Point Registers must be treated as they should be.

%R (Holding Registers) = (3000 + %R -1) or (3000 +%R)

%T (Temporary Bits) = (6000 + %T -1) or (6000 +%T)

%M (Retentive Bits) = (3000 + %M -1) or (3000 +%M)

%Q (Digital Output) = (0000 + %Q - 1) or (0000 +%Q)

%I (Digital Input) = (0000 + %I - 1) or (0000 +%I)

%AI (Analog Input) + (0000 + %AI -1) or (0000 +%AI)

MODBUS

MEMORY MAP FOR SERIAL AND ETHERNET TCP/IP AND HTTP COMMUNICATION

EVENT REGISTERS (16 BIT) (Read Only)

%R1001 Last Event / First Fail
 %R1002 Last Start Hour.
 %R1003 Last Start Minute.
 %R1004 Last Start Day.
 %R1005 Last Start Month.
 %R1006 Last Start Year.
 %R1007 Last Stop Hour.
 %R1008 Last Stop Minute.
 %R1009 Last Stop Day.
 %R1010 Last Stop Month.
 %R1011 Last Stop Year.
 %R1012 Last Event Hour
 %R1013 Last Event Minute
 %R1014 Last Event Day
 %R1015 Last Event Month.
 %R1016 Last Event Year.
 %R1022 Total Start Times.
 %R453 Total Running Minutes
 %R455 Total Running Hour.
 %R457 Total Life Hour.
 %R461 Total Life Minute.

Table of Values for %R1001 Events

Value: Event:

0: None
 1: Under voltage
 2: Over voltage
 3: Reserved (Under/Over frequency)
 4: Field Under current
 5: Field Over current
 6: Over Lead
 7: Over Lag
 8: Line Under current
 9: Line Over current
 10: Line Under power
 11: Line Over power
 12: Start Too Long
 13: Exciter Over temperature
 14: External Fail
 15: Field Loss
 16: Lost Control
 17: Reserved (Field Short Circuit)
 18: Normal Start
 19: Normal Stop
 20: Firing Fail

READINGS (Read Only) (F.P. = Float Point)

%R821 Reserved (Field Voltage).
 %R823 Line Voltage. 32 Bit / F.P.
 %R825 Line Current. 32 Bit / F.P.
 %R827 Field Current. 32 Bit / F.P.
 %R829 Power Factor. 32 Bit / F.P.
 %R775 Power Factor Angle. 8 Bit
 Values: 0: Lag / 1: Lead
 %R831 Reserved. 32 Bit / F.P.
 %R857 Reserved (Field Temperat.)
 %R865 KVA / MVA. 32 Bit / F.P.
 %R153.10 KVA / MVA Factor
 0= KVA / 1= MVA
 %R867 KVAR / MVAR. 32 Bit / F.P.
 %R153.11 KAV / MVA Factor
 0= KVAR / 1= MVAR
 %R153.4 Quadrant = G / M.
 0= Generator / 1= Motor
 %R869 KW /MW. 32 Bit / F.P.
 %R153.12 KW / MW Factor
 0= KW / 1= MW

MODBUS

MEMORY MAP FOR SERIAL AND ETHERNET TCP/IP AND HTTP COMMUNICATION

Programing Register (Read/Write) (In the order they appear in the Menus)

%R123 Regulator Modes 16 Bit	%R235 Under Voltage Level 32 Bit	%R324 PID2 Control Word 16 Bit
%R128 Operating Mode 16 Bit	%R237 Over Voltage Level 32 Bit	%R305 PID1 Derivative Time 16 Bit
%R161 Control Input 1 16 Bit	%R247 Under Power Trip Level 32 Bit	%R325 PID2 Derivative Time 16 Bit
%R162 Control Input 2 16 Bit	%R249 Over Power Trip Level 32 Bit	%R306 PID1 Integrative Rate 16 Bit
%R163 Control Input 3 16 Bit	%R203 Under Excit. Limit 32 Bit	%R326 PID2 Integrative Rate 16 Bit
%R164 Control Input 4 16 Bit	%R207 Over Excit. Limit 32 Bit	%R310 PID1 Slew Time 16 Bit
%R703 Actual Source 16 Bit	%R205 Under Excit. Trip Level 32 Bit	%R330 PID2 Slew Time 16 Bit
%R159 Mute Mode 16 Bit	%R209 Over Excit. Trip Level 32 Bit	%R309 PID1 Low Clamp 16 Bit
%R160 Reset Mode 16 Bit	%R211 Lead Angle Limit 32 Bit	%R329 PID2 Low Clamp 16 Bit
%R126 Booster Mode 16 Bit	%R215 Lag Angle Limit 32 Bit	%R308 PID1 High Clamp 16 Bit
%R138 Auto Man. Mode 16 Bit	%R213 Lead Angle Trip Level 32 Bit	%R328 PID2 High Clamp 16 Bit
%R131 Man. Auto Mode 16 Bit	%R217 Lag Angle Trip Level 32 Bit	%R307 PID1 Bias 16 Bit
%R125 Up Down ST Mode 16 Bit	%R219 Droop Rate 32 Bit	%R327 PID2 Bias 16 Bit
%R151 Flag Word 1 16 Bit	%R221 Compound Rate 32 Bit	%R707 Preset Setpoint 1 32 Bit Real
%R773 Scale Mode 16 Bit	%R225 Limiting Gain 32 Bit	%R705 Preset Setpoint 2 32 Bit Real
%R134 Digital Output 1 16 Bit	%R223 Pull In Booster 32 Bit	%R361 Filter 1 16 Bit
%R135 Digital Output 1 16 Bit	%R233 Operating Hour Level 32 Bit	%R362 Filter 2 16 Bit
%R137 Digital Output 3 16 Bit	%R101 Under Voltage Action 16 Bit	%R363 Filter 3 16 Bit
%R138 Digital Output 4 16 Bit	%R102 Over Voltage Action 16 Bit	%R364 Filter 4 16 Bit
%R149 Save Screen Bright 16 Bit	%R103 Under Excitation Action 16 Bit	%R622 Modbus Address 16 Bit
%R140 Save Screen Reg 16 Bit	%R106 Over Excitation Action 16 Bit	%R621 Modbus Baud Rate 16 Bit
%R141 Save Screen Time 16 Bit	%R107 Lead Angle Action 16 Bit	%R623 Modbus Parity 16 Bit
%R150 Screen Bright Saving 16 Bit	%R108 Lag Angle Action 16 Bit	%R625 Modbus Handshake 16 Bit
%R435 Nominal Motor Voltage 16 Bit	%R109 Under Current Action 16 Bit	%R624 Modbus Timeout 16 Bit
%R437 Nominal Motor Current 16 Bit	%R110 Over Current Action 16 Bit	%R610 Modbus On 16 Bit
%R409 Nominal Line Current 32 Bit	%R111 Under Power Action 16 Bit	%R261 Line Current Trend Scale 16 Bit
%R403 Nominal Line Voltage 32 Bit	%R112 Over Power Action 16 Bit	%R262 Line Voltage Trend Scale 16 Bit
%R401 Nominal Motor KVA 32 Bit	%R114 Over Temperature Action 16 Bit	%R263 Active Power Trend Scale 16 Bit
%R415 Nominal Field Current 32 Bit	%R115 External Fail Action 16 Bit	%R264 Aparent Power Trend Scale 16 Bit
%R423 Secondary Exciter Transf. 32 Bit	%R116 Field Voltage Loss Action 16 Bit	%R265 React. Power Trend Scale 16 Bit
%R421 Nominal Motor PF 32 Bit Dword	%R120 Firing Fail Action 16 Bit	%R266 Field Current Trend Scale 16 Bit
%R411 Line Curr. Transf. Ratio 32 Bit	%R117 Lost off Control Action 16 Bit	%R260 Enable Plot Restart 16 Bit
%R405 Line Volt. Transf. Ratio 32 Bit	%R113 Start Time Too Long Action 16 Bit	%R268 Enable Retentive Plot 16 Bit
%R417 F.C. Transf. Ratio 5V 32 Bit	%R121 OperatingHour Action 16 Bit	%R10 Mode Flags Word 16 Bit
%R177 FAR Delay 16 Bit	%R142 Memory Card Fail Action 16 Bit	
%R190 FCX Delay 16 Bit	%R178 Under Voltage Delay 16 Bit	
%R132 FAR Mode 16 Bit	%R179 Over Voltage Delay 16 Bit	
%R133 FCX Mode 16 Bit	%R182 Under Excitation Delay 16 Bit	
%R193 Start Cold 16 Bit	%R183 Over Excitation Delay 16 Bit	
%R198 Start Hot 16 Bit	%R184 Lead Angle Delay 16 Bit	
%R196 Auto Mute Delay 16 Bit	%R185 Lag Angle Delay 16 Bit	
%R197 Auto Reset Delay 16 Bit	%R186 Under Current Delay 16 Bit	
%R199 Trip Pulse Time 16 Bit	%R187 Over Current Delay 16 Bit	
%R200 Motor Start Time 16 Bit	%R188 Under Power Delay 16 Bit	
%R229 Booster Time (%R229) 16 Bit	%R189 Over Power Delay 16 Bit	
%R151 Flags Word 1 16 Bit	%R191 Over Temperature Delay 16 Bit	
%R152 Flags Word 2 16 Bit	%R192 External Fail Delay 16 Bit	
%R201 PF Droop Point 32 Bit	%R174 Field Loss Delay 16 Bit	
%R122 Call Screen On Fail 16 Bit	%R175 Firing Fail Delay 16 Bit	
%R243 Under Curr. Trip Level 32 Bit	%R194 Lost Off Control Delay 16 Bit	
%R245 Over Curr. Trip Level 32 Bit	%R302 PID1 Dead Band 16 Bit	
	%R322 PID2 Dead Band 16 Bit	
	%R311 PID1 Control Word 16 Bit	
	%R331 PID2 Control Word 16 Bit	
	%R304 PID1 Control Word 16 Bit	

ETHERNET IP DATA TABLE

ETHERNET IP PROTOCOL



ATTENTION: Registers %R2801 to %R2928 are the same as those used in the Modbus map for communication via TCP/IP and HTTP protocols.

TRANSMITTED DATA (Register R) (Produced) (READ ONLY)

Note that these data can be read normally via the TCP/IP (Modbus Over Ethernet) protocol.

NOTE: 32-bit data must be read in two 16-bit words. That is, after reading the register listed below, the subsequent register must also be read, and then both readings must be converted to a 32-bit Dword or Real Number, as applicable.

%R2801.1 AlarmActive
 %R2802.1 TripActive
 %R2803.1 Fail Active
 %R2804.1 Forcing Setpoint
 %R2805.1 Forcing Mode
 %R2806.1 Any Force Active
 %R2801.1 Limiting Active
 %R2808 Operation Mode Table
 %R2809 Main Variable Table
 %R2810 Actual State Table
 %R2811 Main Variable Unity Table
 %R2812 Setpoint Limiting Indication
 %R2813 Channel (P-S) Indication
 %R2814.1 Start Permission OK
 %R2815.1 Starting
 %R2816.1 FAR OK
 %R2817.1 Booster ON
 %R2818.1 FCX OK
 %R2819.1 Running
 %R2820.1 Mode Fail
 %R2821 Process Limiting Indication
 %R2822 Reserved
 %R2823.1 Adjust Range 20%
 %R2824.1 Reserved
 %R2825.1 Limiting Lead Angle
 %R2826.1 Limiting Lag Angle
 %R2827.1 Clamping Maximum
 %R2828.1 Clamping Minimum
 %R2829.1 Limiting Droop
 %R2830.1 Limiting Over Excitation
 %R2831.1 Limiting Under Excitation

%R2832.1 Alarm Unacknowledged
 %R2833.1 Alarm Uncleared
 %R2834.1 No Memory Card at Slot
 %R2835.1 Memory Card OK
 %R2836.1 Under Voltage Fail Active
 %R2837.1 Over Voltage Fail Active
 %R2838.1 Under Current Fail Active
 %R2839.1 Over Current Fail Active
 %R2840.1 Under Excitation Fail Active
 %R2841.1 Over Excitation Fail Active
 %R2842.1 Lead Angle Fail Active
 %R2843.1 Lag Angle Fail Active
 %R2844.1 Reserved
 %R2845.1 Reserved
 %R2846.1 Under Power Fail Active
 %R2847.1 Over Power Fail Active
 %R2848.1 Start Too Long Fail Active
 %R2849.1 OverTemper. Fail Active
 %R2850.1 External Fail Active
 %R2851.1 Field Loss Fail Active
 %R2852.1 Lost Control Fail Active
 %R2853.1 Firing Fail Active
 %R2854.1 Operating Hour Fail Active
 %R2855.1 Memory Card Fail Active
 %R2856 Cold Hot Motor Status Table
 %R2857 Time to New Start
 %R2858 Primary Setpoint
 %R2859 Secondary Setpoint
 %R2860 Primary Chan. Process Value
 %R2861 Second. Chan. Process Value
 %R2862 Motor Voltage
 %R2863 Motor Line Current
 %R2864 Motor Line Current Percent
 %R2865 Motor Line Voltage Percent
 %R2866 Motor Field Current Percent
 %R2867 Motor KVA Percent
 %R2868 Motor KW Percent
 %R2869 Motor KVAR Percent
 %R2870 Motor Power Factor Percent
 %R2871 Total Excitation Times
 %R2872 Last Event Hour
 %R2873 Last Event Minute
 %R2874 Last Event Day
 %R2875 Last Event Month
 %R2876 Last Event Year
 %R2877 Last Excitation Hour
 %R2878 Last Excitation Minute
 %R2879 Last Excitation Day
 %R2880 Last Excitation Month
 %R2881 Last Excitation Year
 %R2882 Last De-Excitation Hour
 %R2883 Last De-Excitation Minutes
 %R2884 Last De-Excitation Day
 %R2885 Last De-Excitation Month
 %R2886 Last De-Excitation Year
 %R2887 Reserved
 %R2889 Total Trips Occurred
 %R2890 Real Time Clock Day
 %R2891 Real Time Clock Month

%R2892 Real Time Clock Year
 %R2893 Real Time Clock Hour
 %R2894 Real Time Clock Minute
 %R2895 Real Time Clock Second
 %R2896 Operating Time Minutes
 %R2897 Operating Time Hour (32 Bit)
 %R2899 Setpoint Total (Real F.P.)
 %R2901 Line Current (Real F.P.)
 %R2903 Line Voltage (Real F.P.)
 %R2905 Field Current (Real F.P.)
 %R2907 Apparent Power (Real F.P.)
 %R2909 Active Power (Real F.P.)
 %R2911 Reserved
 %R2912 Reserved
 %R2913 Power Factor (Real F.P.)
 %R2915 Nominal KVA (Real F.P.)
 %R2917 Nominal Power Factor (F.P.)
 %R2919 Total Life Hour (32 Bits)
 %R2921 Total Life Minutes (16 Bits)
 %R2922 Reserved
 %R2923 Total Excited Hours (32 Bits)
 %R2925 Total Excited Minutes
 %R2926 Reserved
 %R2927 Reserved
 %R2928 Reserved

DATA RECEIVED (Register R) (CONSUMED -

Note: Note that via the TCP/IP Protocol (Modbus Over Ethernet) the same data can be read or written normally.

%R3201.1 Mute Command
 %R3202.1 Reset Command
 %R3203.1 Reset The Force State
 %R3204.1 Force Manual Open Loop
 %R3205.1 Force Manual Field Current
 %R3206.1 Setpoint Up Command
 %R3207.1 Setpoint Down Command
 %R3208.1 Up/Down Velocity 1
 %R3209.1 Up/Down Velocity 2

MODBUS OVER ETHERNET MAP 1/4



MODBUS OVER ETHERNET MAP FOR VED905L SYNCHRONOUS MOTOR EXCITATION RELAY					
MODBUS OVER ETHERNET ETHERNET IP SERVER COMMUNICATION WILL WORK WITH PLCs AND ALLEN BRADLEY PROTOCOL OR ALLEN BRADLEY LIKE					
Maximum connection = 2 /// PORT = 44818 TCP or 2222 UDP					
SEND (PRODUCED) FIRST REGISTER = %R2801 /// LAST REGISTER = %R2928 /// WORDS COUNT = 128					
RECEIVE (CONSUMED) FIRST REGISTER = %R3201 /// LAST REGISTER = %R3328 /// WORDS COUNT = 128					
The Status word provides Ethernet/IP connection status. The upper byte of the word contains the Class 3 (Explicit) connection count and the lower byte contains the Class 1 (IO) connection count.					
NOTE: When the Status word indicates no connections, the Consumed Relay registers contain old data					
As up to 128 words are allowed in each communication, a pagination scheme is used to access all important and available data.					
In this version, parameter programming via the Ethernet connection is not allowed due to security reasons.					
However, it is allowed to send some commands via the Ethernet connection.					
IN THE PLC CONNECTION PARAMETER, USE "100" FOR THE ASSEMBLY INSTANCE INPUT WITH SIZE = 128 AND "101" FOR THE ASSEMBLY INSTANCE OUTPUT WITH SIZE = 128					
CONSUMED	CONTROLLER TAGS	REGISTER	FUNCTION	DATA	NOTE
%R3201	O.Data[100]	INTEGER 16 BITS	TICK MUTE	1= MUTE // 0 = DO NOTHING	SEND COMMAND MUTE TO RELAY
%R3202	O.Data[101]	INTEGER 16 BITS	TICK RESET	1= RESET // 0 = DO NOTHING	SEND COMMAND RESET TO RELAY
%R3203	O.Data[102]	INTEGER 16 BITS	TICK RESET THE FORCE MODE	1= RESET THE MODE TO NORMAL // 0 = DO NOTHING	TURN OFF THE FORCE COMMAND IF IT IS ACTIVE
%R3204	O.Data[103]	INTEGER 16 BITS	TICK FORCE MANUAL OPEN LOOP	1= FORCE MANUAL OPEN LOOP // 0 = DO NOTHING	SEND FORCE COMMAND TO CHANGE TO MANUAL OPEN LOOP
%R3205	O.Data[104]	INTEGER 16 BITS	TICK FORCE MANUAL FIELD CURRENT	1= FORCE MANUAL FIELD CURR. // 0 = DO NOTHING	SEND FORCE COMMAND TO CHANGE TO MANUAL FIELD CURR
%R3206	O.Data[105]	INTEGER 16 BITS	TICK SET POINT UP	0>1 TICK INCREMENT SETPOINT BY 0.01 %	EACH ACTIVATION SENDS A SINGLE UP PULSE
%R3207	O.Data[106]	INTEGER 16 BITS	TICK SETPOINT DOWN	0>1 TICK DECREMENT SETPOINT BY 0.01 %	EACH ACTIVATION SENDS A SINGLE DOWN PULSE
%R3208	O.Data[107]	INTEGER 16 BITS	SETPOINT VELOCITY 1	CHANGE SETPOINT VELOCITY TO 0.05 %	IF <ON> THE SETPOINT INCREMENT VELOCITY IS 5X HIGHER
%R3209	O.Data[108]	INTEGER 16 BITS	SETPOINT VELOCITY 2	CHANGE SETPOINT VELOCITY TO 0.1 %	IF <ON> THE SETPOINT DECREMENT VELOCITY IS 5X HIGHER
%R3210 - %R3328		INTEGER 16 BITS	RESERVED		

MODBUS OVER ETHERNET MAP 2/4

VED905 V5L

PRODUCED	CONTROLLER TAGS	REGISTER	FUNCTION	DATA	NOTE
%R2801	I.Data[0]	INTEGER 16 BITS	ALARM ACTIVE	0= NO // 1= YES	
%R2802	I.Data[1]	INTEGER 16 BITS	TRIP ACTIVE	0= NO // 1= YES	
%R2803	I.Data[2]	INTEGER 16 BITS	FAIL ACTIVE	0= NO // 1= YES	
%R2804	I.Data[3]	INTEGER 16 BITS	SETPOINT FORCED	0= NO // 1= YES	
%R2805	I.Data[4]	INTEGER 16 BITS	OPERATION MODE FORCED	0= NO // 1= YES	
%R2806	I.Data[5]	INTEGER 16 BITS	RESERVED		
%R2807	I.Data[6]	INTEGER 16 BITS	LIMITING	0= NO // 1= YES	
%R2808	I.Data[7]	INTEGER 16 BITS	OPERATION MODE	0= AUTOMATIC // 1= MANUAL OPEN LOOP // 1 = MANUAL FIELD CURRENT	
%R2809	I.Data[8]	INTEGER 16 BITS	MAIN VARIABLE AT THE MOMENT	1= FIELD AMP // 2= PWR FACTOR // 3= KYAR // 4= MVAR // 5= FLD APF // 6= FLD A/ VAR //	
%R2810	I.Data[9]	INTEGER 16 BITS	ACTUAL STATE	1= INHIBIT // 2= STANDBY // 3= STARTING // 4= BOOSTER // 5= FAIL // 6= ALARM ACTIVE //	
%R2811	I.Data[10]	INTEGER 16 BITS	MAIN VARIABLE UNITY / INDICATOR	1= LAG // 1= LEAD // 2= NONE // 3= FORCED // 4= AMP // 5= FLD CURR // 6= PF	
%R2812	I.Data[11]	INTEGER 16 BITS	SETPOINT LIMIT REACHED	0= NO // 1= LOWER LIMIT REACHED // 2= UPPER LIMIT REACHED	
%R2813	I.Data[12]	INTEGER 16 BITS	ACTUAL SETPOINT ACTIVE	0= (P) PRIMARY // 1= (S) SECONDARY	
%R2814	I.Data[13]	INTEGER 16 BITS	START PERMISSION	0= NO // 1= YES	
%R2815	I.Data[14]	INTEGER 16 BITS	MOTOR STARTED	0= NO // 1= YES	
%R2816	I.Data[15]	INTEGER 16 BITS	EXCITED (FAR ACTIVE)	0= NO // 1= YES	
%R2817	I.Data[16]	INTEGER 16 BITS	BOOSTER ACTIVE	0= NO // 1= YES	
%R2818	I.Data[17]	INTEGER 16 BITS	LOADED (FCX ACTIVE)	0= NO // 1= YES	
%R2819	I.Data[18]	INTEGER 16 BITS	MOTOR RUNNING (END OF STARTING)	0= NO // 1= YES	
%R2820	I.Data[19]	INTEGER 16 BITS	MODE FAIL ACTIVE	0= NO // 1= YES	
%R2821	I.Data[20]	INTEGER 16 BITS	PROCESS LIMIT REACHED	0= NO // 1= LOWER LIMIT REACHED // 2= UPPER LIMIT REACHED	
%R2822	I.Data[21]	INTEGER 16 BITS	RESERVED		
%R2823	I.Data[22]	INTEGER 16 BITS	ADJUST RANGE	0= +/- 20% // 1= +/- 100%	
%R2824	I.Data[23]	INTEGER 16 BITS	RESERVED		
%R2825	I.Data[24]	INTEGER 16 BITS	LEAD LIMIT REACHED	0= NO // 1= YES	
%R2826	I.Data[25]	INTEGER 16 BITS	LAG LIMIT REACHED	0= NO // 1= YES	
%R2827	I.Data[26]	INTEGER 16 BITS	UPPER POD CLAMPING REACHED	0= NO // 1= YES	
%R2828	I.Data[27]	INTEGER 16 BITS	LOWER POD CLAMPING REACHED	0= NO // 1= YES	
%R2829	I.Data[28]	INTEGER 16 BITS	DROOP LIMIT REACHED	0= NO // 1= YES	
%R2830	I.Data[29]	INTEGER 16 BITS	OVER EXCITATION LIMIT REACHED	0= NO // 1= YES	
%R2831	I.Data[30]	INTEGER 16 BITS	UNDER EXCITATION LIMIT REACHED	0= NO // 1= YES	
%R2832	I.Data[31]	INTEGER 16 BITS	ALARM UNACKNOWLEDGED	0= NO // 1= YES	
%R2833	I.Data[32]	INTEGER 16 BITS	ALARM UNCLEARED	0= NO // 1= YES	
%R2834	I.Data[33]	INTEGER 16 BITS	NO CARD IN SLOT FAIL	0= NO // 1= YES	
%R2835	I.Data[34]	INTEGER 16 BITS	CARD OK	0= NO // 1= YES	
%R2836	I.Data[35]	INTEGER 16 BITS	UNDER VOLTAGE FAIL	0= NO // 1= YES	
%R2837	I.Data[36]	INTEGER 16 BITS	OVER VOLTAGE FAIL	0= NO // 1= YES	

MODBUS OVER ETHERNET MAP 3/4

VED905 V5L

PRODUCED	CONTROLLER TAGS	REGISTER	FUNCTION	DATA	NOTE
%R2838	I.Data[37]	INTEGER 16 BITS	UNDER CURRENT FAIL	0= NO // 1= YES	
%R2839	I.Data[38]	INTEGER 16 BITS	OVER CURRENT FAIL	0= NO // 1= YES	
%R2840	I.Data[39]	INTEGER 16 BITS	UNDER EXCITATION FAIL	0= NO // 1= YES	
%R2841	I.Data[40]	INTEGER 16 BITS	OVER EXCITATION FAIL	0= NO // 1= YES	
%R2842	I.Data[41]	INTEGER 16 BITS	LEAD ANGLE FAIL	0= NO // 1= YES	
%R2843	I.Data[42]	INTEGER 16 BITS	LAG ANGLE FAIL	0= NO // 1= YES	
%R2844	I.Data[43]	INTEGER 16 BITS	RESERVED	0= NO // 1= YES	
%R2845	I.Data[44]	INTEGER 16 BITS	RESERVED	0= NO // 1= YES	
%R2846	I.Data[45]	INTEGER 16 BITS	UNDER POWER FAIL	0= NO // 1= YES	
%R2847	I.Data[46]	INTEGER 16 BITS	OVERPOWER FAIL	0= NO // 1= YES	
%R2848	I.Data[47]	INTEGER 16 BITS	START TOO LONG FAIL	0= NO // 1= YES	
%R2849	I.Data[48]	INTEGER 16 BITS	OVERTEMPERATURE FAIL	0= NO // 1= YES	
%R2850	I.Data[49]	INTEGER 16 BITS	EXTERNAL FAIL	0= NO // 1= YES	
%R2851	I.Data[50]	INTEGER 16 BITS	FILED LOSS FAIL	0= NO // 1= YES	
%R2852	I.Data[51]	INTEGER 16 BITS	LOST OF CONTROL FAIL	0= NO // 1= YES	
%R2853	I.Data[52]	INTEGER 16 BITS	FIRING IGBT FAIL	0= NO // 1= YES	
%R2854	I.Data[53]	INTEGER 16 BITS	EXCESS OPERATING HOURS ALARM	0= NO // 1= YES	
%R2855	I.Data[54]	INTEGER 16 BITS	MEMORY CARD FAIL	0= NO // 1= YES	
%R2856	I.Data[55]	INTEGER 16 BITS	MOTOR STATUS	0= COOLED // 1= RUNNING COLD // 2= RUNNING HOT // 3= STOPPED COLD // 4= STOPPED HOT	
%R2857	I.Data[56]	INTEGER 16 BITS	TIME TO NEW START	IN SECONDS	
%R2858	I.Data[57]	INTEGER 16 BITS	PRIMARY SETPOINT %	AS READED	
%R2859	I.Data[58]	INTEGER 16 BITS	SECONDARY SETPOINT %	AS READED	
%R2860	I.Data[59]	INTEGER 16 BITS	PRIMARY PROCESS VALUE %	AS READED	
%R2861	I.Data[60]	INTEGER 16 BITS	SECONDARY PROCESS VALUE %	AS READED	
%R2862	I.Data[61]	INTEGER 16 BITS	NOMINAL MOTOR VOLTAGE (V)	AS READED	
%R2863	I.Data[62]	INTEGER 16 BITS	NOMINAL MOTOR CURRENT (A)	AS READED	
%R2864	I.Data[63]	INTEGER 16 BITS	LINE CURRENT %	AS READED	
%R2865	I.Data[64]	INTEGER 16 BITS	LINE VOLTAGE %	AS READED	
%R2866	I.Data[65]	INTEGER 16 BITS	FIELD CURRENT %	AS READED	
%R2867	I.Data[66]	INTEGER 16 BITS	(VA) APARENTE POWER %	AS READED	
%R2868	I.Data[67]	INTEGER 16 BITS	(W) ACTIVE POWER %	AS READED	
%R2869	I.Data[68]	INTEGER 16 BITS	(VAR) REACTIVE POWER %	AS READED	
%R2870	I.Data[69]	INTEGER 16 BITS	POWER FACTOR %	AS READED	
%R2871	I.Data[70]	INTEGER 16 BITS	TOTAL EXCITATION TIMES	AS READED	
%R2872	I.Data[71]	INTEGER 16 BITS	LAST EVENT HOUR	AS READED	
%R2873	I.Data[72]	INTEGER 16 BITS	LAST EVENT MINUTES	AS READED	
%R2874	I.Data[73]	INTEGER 16 BITS	LAST EVENT DAY	AS READED	
%R2875	I.Data[74]	INTEGER 16 BITS	LAST EVENT MONTH	AS READED	
%R2876	I.Data[74]	INTEGER 16 BITS	LAST EVENT YEAR	AS READED	

MODBUS OVER ETHERNET MAP 4/4

VED905 V5L

PRODUCED	CONTROLLER TAGS	REGISTER	FUNCTION	DATA	NOTE
%R2877	I.Data[75]	INTEGER 16 BITS	LAST EXCITATION HOUR	AS READED	
%R2878	I.Data[76]	INTEGER 16 BITS	LAST EXCITATION MINUTES	AS READED	
%R2879	I.Data[77]	INTEGER 16 BITS	LAST EXCITATION DAY	AS READED	
%R2880	I.Data[78]	INTEGER 16 BITS	LAST EXCITATION MONTH	AS READED	
%R2881	I.Data[79]	INTEGER 16 BITS	LAST EXCITATION YEAR	AS READED	
%R2882	I.Data[80]	INTEGER 16 BITS	LAST DESEXCITATION HOUR	AS READED	
%R2883	I.Data[81]	INTEGER 16 BITS	LAST DESEXCITATION MINUTES	AS READED	
%R2884	I.Data[82]	INTEGER 16 BITS	LAST DESEXCITATION DAY	AS READED	
%R2885	I.Data[83]	INTEGER 16 BITS	LAST DESEXCITATION MONTH	AS READED	
%R2886	I.Data[84]	INTEGER 16 BITS	LAST DESEXCITATION YEAR	AS READED	
%R2887	I.Data[85]	INTEGER 16 BITS	RESERVED	AS READED	
%R2888	I.Data[86]	INTEGER 16 BITS	TOTAL ALARMS	AS READED	
%R2889	I.Data[87]	INTEGER 16 BITS	TOTAL TRIPS	AS READED	
%R2890	I.Data[88]	INTEGER 16 BITS	REAL TIME CLOCK DAY	AS READED	
%R2891	I.Data[89]	INTEGER 16 BITS	REAL TIME CLOCK MONTH	AS READED	
%R2892	I.Data[90]	INTEGER 16 BITS	REAL TIME CLOCK YEAR	AS READED	
%R2893	I.Data[91]	INTEGER 16 BITS	REAL TIME CLOCK HOUR	AS READED	
%R2894	I.Data[92]	INTEGER 16 BITS	REAL TIME CLOCK MINUTES	AS READED	
%R2895	I.Data[93]	INTEGER 16 BITS	REAL TIME CLOCK SECONDS	AS READED	
%R2896	I.Data[94]	INTEGER 16 BITS	OPERATING TIME MINUTES	AS READED	
%R2897-%R2898	I.Data[95]-I.Data[96]	DWORD 32 BITS	OPERATING TIME HOURS	AS READED	ATTENTION: -DWORD> TYPE WITH 32 BITS
%R2899-%R2900	I.Data[97]-I.Data[98]	REAL 32 BITS	TOTAL SET POINT %	AS READED	ATTENTION: -REAL WORD> TYPE WITH 32 BITS
%R2901-%R2902	I.Data[99]-I.Data[100]	REAL 32 BITS	LINE CURRENT (A)	AS READED	ATTENTION: -REAL WORD> TYPE WITH 32 BITS
%R2903-%R2904	I.Data[101]-I.Data[102]	REAL 32 BITS	LINE VOLTAGE (V)	AS READED	ATTENTION: -REAL WORD> TYPE WITH 32 BITS
%R2905-%R2906	I.Data[103]-I.Data[104]	REAL 32 BITS	FIELD CURRENT (A)	AS READED	ATTENTION: -REAL WORD> TYPE WITH 32 BITS
%R2907-%R2908	I.Data[105]-I.Data[106]	REAL 32 BITS	APPARENT POWER (VA)	AS READED	ATTENTION: -REAL WORD> TYPE WITH 32 BITS
%R2909-%R2910	I.Data[107]-I.Data[108]	REAL 32 BITS	ACTIVE POWER (W)	AS READED	ATTENTION: -REAL WORD> TYPE WITH 32 BITS
%R2911-%R2912	I.Data[109]-I.Data[110]	REAL 32 BITS	REACTIVE POWER (VAR)	AS READED	ATTENTION: -REAL WORD> TYPE WITH 32 BITS
%R2913-%R2914	I.Data[111]-I.Data[112]	REAL 32 BITS	POWER FACTOR	AS READED	ATTENTION: -REAL WORD> TYPE WITH 32 BITS
%R2915-%R2916	I.Data[113]-I.Data[114]	REAL 32 BITS	NOMINAL APPARENTE POWER (KVA)	AS READED	ATTENTION: -REAL WORD> TYPE WITH 32 BITS
%R2917-%R2918	I.Data[115]-I.Data[116]	REAL 32 BITS	NOMINAL LINE CURRENT (A)	AS READED	ATTENTION: -REAL WORD> TYPE WITH 32 BITS
%R2919-%R2920	I.Data[117]-I.Data[118]	DWORD 32 BITS	TOTAL LIFE HOUR	AS READED	ATTENTION: -DWORD> TYPE WITH 32 BITS
%R2921	I.Data[119]	INTEGER 16 BITS	TOTAL LIFE MINUTES	AS READED	
%R2922	I.Data[120]	INTEGER 16 BITS	RESERVED	AS READED	
%R2923-%R2924	I.Data[121]-I.Data[122]	DWORD 32 BITS	TOTAL EXCITED HOUR	AS READED	ATTENTION: -REAL WORD> TYPE WITH 32 BITS
%R2925	I.Data[123]-I.Data[124]	INTEGER 16 BITS	TOTAL EXCITED MINUTES	AS READED	
%R2926	I.Data[125]-I.Data[126]	INTEGER 16 BITS	RESERVED	AS READED	
%R2927	I.Data[127]-I.Data[128]	INTEGER 16 BITS	RESERVED	AS READED	

CODE

ORDER CODE

- Excitation System for Synchronous Motors: **VED905 V5L/xxxA/yyyV/m/n/p/r/zzz**
- **xxx** is the rated current of the power module.
- **yyy** is the ceiling voltage for the machine field.
- **m** is the power control mode: **T**=thyristors or **I**=IGBT
- **n** is the protocol inclusion option: **N**=No, **D**=Devicenet, **C**=Cscan
- **p** is the add Ethernet server option: **N**=No, **E**=Yes
- **r** is the option to include a memory card for operation in 'Fail Safe Mode': **0**=No, **F**= Yes
- **zzz** is the voltage of the cooling fans (127Vac or 220Vac).
- Interconnection Cable: **DB25-V5L**
- Replacement controller only: **VED905 V5LC**
- Replacement power module only: **VED905 V5LP/xxxA/yyyV/m/n/zzzVcal**

Complete System Example: **VED905 XL5/25A/200V/I/N/N/E/0/220VCA**

It would be a system with VED905 V5L controller + 25A Power Module and 200V field voltage, with IGBT control, without Devicenet or Cscan, without Ethernet, with memory card for 'Fail Safe' operation and with 220 VAC fans .

OTHER EXCITATION LINE ITEMS AVAILABLE:

- **STATVAR**: Complete panel for low voltage synchronous motor excitation control.
- **POWERAMP**: Complete Starting and Excitation System for Medium Voltage Synchronous Motors.
- **PLC605**: PLC with Touch Screen to control excitation systems.
- **VSA605A** - Shunt Amplifier (60 mV/5V isolated).
- **VP1020E** - Panel with Multiturn Potentiometer and digital scale.
- **VR8020** - Start Supervision Relay.
- **VR9045** - Field Application Relay.
- **VR9030A** - Earth Fault Relay.
- **VR9031A** - Field Overvoltage Relay.
- **VR9032A** - Field Overcurrent Relay.
- **VR9035A** - Synchronism Loss Relay ("Step Out").
- **VR9034A** - Field Loss Relay.
- **M1** - M1 type Synchronism Module for internal use in Synchronous Motors.
- **M2** - Synchronism module type M2 for internal use in Synchronous Motors.
- **M3** - Synchronism Module type M3, Microprocessed, for internal use in Synchronous Motors.
- **Crowbar symmetrical**: from 50 to 1000 Amps.
- **Crowbar symmetrical**: from 50 to 1000 Amps.
- Other protection relays.
- Ultra-fast fuses.
- Power Transformers.
- Sensing transformers.
- Current Transformers.

ABOUT VARIXX

For over 40 years, Varixx has pursued its vocation for developing high-tech products and focuses its efforts on serving the industrial market with quality and speed. Our know-how in power electronics has allowed us to offer the market a wide range of products that have become known for their long service life and reliability. We are a pioneering company in Brazil and one of the first worldwide to manufacture digital excitation systems for Generators and Synchronous Motors, as well as Solid State Contactors. We were the creators of the global online thermography market, with the Zyggot line, which is becoming a global reference in the market for temperature monitoring and diagnostics and arc flash detection in electrical systems in general. Our product portfolio also includes LED luminaires from our ONNO division, developed and manufactured 100% in Brazil with cutting-edge technology. Varixx values the introduction of innovative concepts worldwide.

AREAS OF ACTIVITY

- ✓ **MANUFACTURERS OF GENERATORS AND SYNCHRONOUS MOTORS**
Static Exciters, Control Box Controllers, Low and Medium Voltage Soft Starters, Semiconductors and Onno LED Luminaires.
- ✓ **PRODUCTION OF ALUMINUM AND HYDROGEN / OXYGEN**
High Current Rectifiers, Solid State Contactors, Intelligent Relay for CCM, Online Thermography System and Arc Voltage Detection and Onno LED Luminaires.
- ✓ **BASE INDUSTRY, MINING AND STEEL ENGINEERING**
Intelligent Relays for MCC's, Low and Medium Voltage Soft Starters, Solid State Contactors, AC/DC Converters for electromagnets, High Current Rectifiers, Online Thermography System, Arc Voltage Detection and Protection and Onno LED Luminaires.
- ✓ **OIL**
Intelligent Relays for MCC's, Static Excitation, Low and Medium Voltage Soft Starters, Solid State Contactors, Online Thermography System, Arc Voltage Detection and Protection and Onno LED Luminaires.
- ✓ **PANEL BUILDERS**
Intelligent Relays for CCM's, Online Thermography, Arc Voltage Detection and Protection System, Semiconductors, Power Supplies and Onno LED Luminaires.

Why Use STATVAR line?



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KNOW MORE!

EXCITATION SYSTEMS FOR SYNCHRONOUS MOTORS AND GENERATORS

- ✓ **Fully Digital**
- ✓ **Analog Versions Available**
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