V5

DIGITAL SOFTSTARTER

Modbus Communication Bus

POWER ELECTRONICS

SERIAL COMMUNICATION V5

Communication Manual S/W 2.1 MT0011 Rev. C

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POWER ELECTRONICS

CONSIGMENT

❑ RECEPTION

- V5 Series soft-starters are carefully tested and properly packed before leaving the factory.
- In the event of transport damage, please ensure that you notify the transport agency and ***POWER ELECTRONICS (+34 96 136 65 57) or your nearest agent***, within 24hrs from receipt of the goods.

❑ UNPACKING

Check the V5 Series packing for the following contents:

- V5 Series soft starter. Make sure soft starter model and serial number matches the markings on the box, delivery note and is the correct unit ordered.
- SERIES COMMUNICATION V5 User's Manual.

❑ SECURITY

- It is installer's responsibility to ensure the configuration and installation of the V5 Series meets the requirements of any site specific, local and national electrical regulations.
- The V5 Series operates from a HIGH VOLTAGE, HIGH ENERGY ELECTRICAL SUPPLY. Always isolate before servicing.
- Service only by qualified personnel. If you have any service or installation questions please contact Power Electronics Technical Department or your local distributor.
- Always wear safety glasses when operating with the door opened.
- The V5 Series contains static sensitive printed circuit boards. Use static safe procedures when handling these boards.

REVISIONS

Date	Revision	Description
January 2002	A	S/W 1.4
January 2003	B	S/W 2.0
March 2004	C	S/W 2.1

SERIAL COMMUNICATION V5

CONTENT

SERIES COMMUNICATION SPECIFICATIONS.

HARDWARE: OPTION RS232, PES Part. No. 0401

Physical level RS232	3 cables, optic-isolated communication, full duplex, simple end of RS232
Terminals	28 GND ISO 29 RS232 RX 30 RS232 TX
Output signal level for RS232	' 1' logic < 6.5 respect to 0V ' 0' logic > 6.5 respect to 0V
Input signal level for RS232	' 1' logic < + 0.8V ' 0' logic > + 2.4V ±30 maximum.
Maximum line impedance	2500pF, 3KΩ
Isolation	±100Vcc earth referred.
Maximum equipment number per RS232 net	1
Maximum cable length	15m

HARDWARE: OPTION RS485, PES Part. No. 0401

Physical level RS485	2 cables, optic-isolated communication, differential-mode, half duplex RS485
Terminals	26 RS485/A 27 RS485/B 28 GND ISO
Input / Output signal level for RS485	' 1' logic = 5 differential ' 0' logic = 5 differential
Isolation	±100Vcc earth referred.
Maximum equipment number per RS485 net	240
Maximum cable length	1000m

SOFTWARE

Communication Protocol	Standard Modbus Communications
Transmission Mode	RTU (Remote Terminal Unit)
Failures Detection	CRC-16 (Cyclical Redundant Code)
Transmission Speed	Selectionable by User between OFF / 1200 / 4800 / 9600
Data length	8 data bits + parity
Parity	Even
Stop Bits	1
Addresses Range	240 unicast addresses (1-240). 15 groupcast addresses (241-255). 1 broadcast address
Response Time	less than 3ms + transmission time
Supported Modbus Functions	3 reading registers 16 writing registers
Supported exception Codes	1. Illegal Function 2. Illegal data Address 3. Illegal data Value 6. Busy, refused message 7. NACK, negative recognition

SERIAL COMMUNICATION V5

1. INTRODUCTION.

The main objective of Series Communication Module of V5 soft-starter is to introduce itself into a compatible net with ModBus communication protocol. This is possible using series communications RS232 or RS485. The series communication module allows V5 soft-starter to be controlled and / or monitoring it like a slave by a ModBus master from a remote location.

The RS485 net allows to connect until 240 equipments to the same net. Nevertheless, RS232 net allows to connect only one unit (slave) to the same net.

The V5 soft-starter functions like a remote slave when is connected to a ModBus system. That means that V5 soft-starter does not start communication task, master will be the who will start such a task.

In practice, all soft-starter running modes, parameters and characteristics are accessible through series communication. For instance, master can give one “Start / Stop order” to soft-starter, or control the soft-starter status, or read the current in motor, …, at the end, it can access to all soft-starter possibilities.

The series communication module uses RS232 and RS485 standard in the physical level and the industrial ModBus protocol for information exchange.

2. INSTALLATION FOR SERIES COMMUNICATION MODULE Ref: E0004 SERIE V5.

1. Switch off the main power supply in order to disconnect the equipment.
2. Insert the PCB to the bottom like figure bellow shows.
3. Switch on the main power supply.

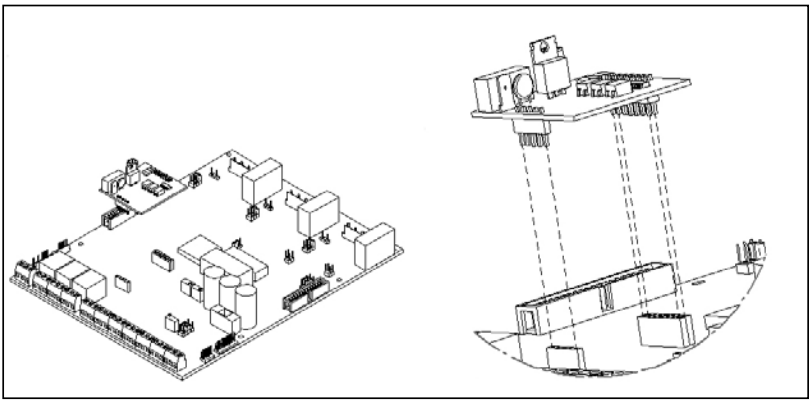


Figure 2.1: Serial Communication Installation.

Series communication module is inserted in the inferior part of control PCB, over 2 female connectors with the followings dimensions 1x5 (lower connector) and 2x7 (upper connector).

***Note**: The series communication module needs separate power supply. This power supply is provided through J1B connector. The power supply voltage must be 9Vef at 50Hz.*

RS232 Wiring.
In the following figure an example of a typical wiring for a RS232 connection is shown:

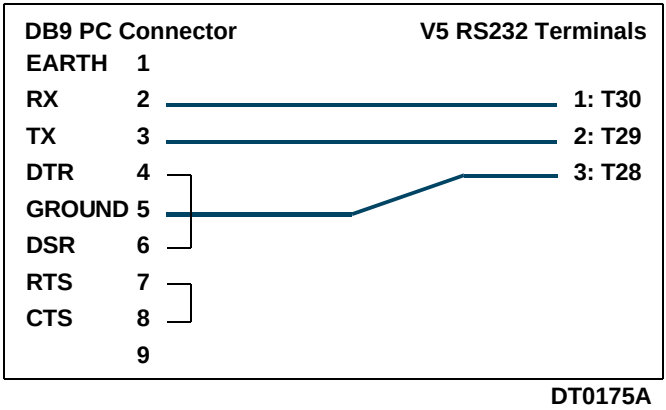


Figure 2.2: RS232 Wiring.

3. SUPPORTED MODBUS FUNCTION CODES.

The series communication protocol implemented in the V5 soft-starter adheres itself completely to the standard industrial communication protocol ModBus from Modicon. Of all existing functions in ModBus protocol, the soft-starter uses read-write functions. These functions are the following:

FUNCTION	DESCRIPTION	Nº OF REGISTERS
3	READING REGISTERS	10*
16	WRITING REGISTERS	10*

Implementation of this function code in the soft-starter allows reading until 10 registers inside the same Parameter Group in a same frame. In case you need to access to consecutive memory registers which belong to different groups, accesses must be done in so many frames as involved groups.

Function Code ModBus nº 3. Registers reading.

This function code allows ModBus controller (master) to read the content of data registers indicated in soft-starter (slave). This function code allows only unicast addressing and it is no possible either broadcast addressing or groupcast addressing

This function code implementation in soft-starter allows to read until 5 soft-starter registers in only one frame.

Next it shows an example frame where the master tries to read the content of 3 registers of a soft-starter where the consumed currents per phase are. The information to be attached in question frame is the following:

- Slave data address.
- Function code ModBus (3 reading registers).
- Starting data address.
- Nº of registers to be read.
- CRC – 16 code.

Soft-starter (slave) answer should contain the following fields:

- Slave data address.
- Function code ModBus (3 reading registers).
- Nº of bytes to be read.
- Nº bytes / 2 registers
- CRC-16 code

Each register is composed of 2 bytes (2x8bits=16 bits). This is the standard length for all soft-starter registers.

Functioning example for function code nº3 (Registers reading).

It can be supposed that we want to read equipment current (data-sheet) through communication system. This data corresponds to parameter G2.1 I EQUIPO. Frame to be transmitted will be:

ModBus Address	Function code ModBus	Starting data address (40022)	Registers number	CRC-16
OAH	03H	00H 15H	00H 01H	94 B5

Figure 3.2 Example of ModBus frame for function code 3

It can be supposed that equipment current (data-sheet) is 110A. Slave response will be:

ModBus Address	Function code ModBus	Bytes number	Data (Address 20) (=110)	CRC-16
OAH	03H	02H	6EH	9CH 69H

Figure 3.3 Example of slave response for a function code 3

Function code ModBus nº 16. Registers writing.

This function code allows ModBus controller (master) to write the data registers content indicated by soft-starter (slave), always such register are “Only Read” registers. Please, take into consideration that writing registers by the master does not avoid these registers to be modified (re-write) by the slave later on.

Implementation of this function code in the soft-starter allows to write until 5 soft-starter registers in only one frame.

Continuously, an example frame, where the master tries to write the content of 1 register where the “Acceleration time” is stored, is attached. The information to be attached in question frame is the following:

- Slave data address.
- Function code ModBus (16 writing registers).
- Starting data address.
- Nº of register to be written.
- Nº of bytes to write
- Content of register to write.
- CRC-16 code.

Slave answer contents:

- Slave data address.
- Function code ModBus (16 writing registers).
- Starting data address.
- Nº of written registers.
- CRC-16 code.

4. V5 SOFT-STARTER REGISTERS

The following descriptions are of all V5 entries that can be accessed via communications.

Parameter Group 0: General information screens

Description	**L1 Phase Current**
V5 parameter	G0.1 L1
Data Address	40185
Data type	r (read)
Units	Amps
Range	0..9999

Description	**L2 Phase Current**
V5 parameter	G0.1 L2
Data Address	40186
Data type	r (read)
Units	Amps
Range	0..9999

Description	**L3 Phase Current**
V5 parameter	G0.1 L3
Data Address	40187
Data Type	r (read)
Units	Amps
Range	0..9999

Description	**Line Voltage L1-L2**
V5 parameter	G0.1 V12
Data Address	40188
Data type	r (read)
Unidades	Volts
Range	0..999

Description	**Line Voltage L2-L3**
V5 parameter	G0.1 V23
Data Address	40189
Data type	r (read)
Units	Volts
Range	0..999

Description	**Line Voltage L1-L3**
V5 parameter	G0.1 V13
Data Address	40190
Data type	r (read)
Units	Volts
Range	0..999

Description	**Supply Frequency**
V5 parameter	G0.3
Data Address	40191
Data type	r (read)
Units	Hz
Range	0..99

Description	**Power Factor**
V5 parameter	G0.3 Cos(ϕ)
Data Address	40192
Data type	r (read)
Units	nil
Range	0..100
Note:	*Cos(ϕ) = Data value of register /100.*

Description	**Motor Torque**
V5 parameter	G0.4
Data Address	40193
Data type	r (read)
Units	%, Motor Torque
Range	0..100

Description	**Motor Power**
V5 parameter	G0.4
Data Address	40194
Data Type	r (read)
Units	kW
Range	0..999

Description	**Relay Status**
V5 parameter	G0.5
Data Address	40195
Data type	r (read)
Units	nil
Range	nil
Note:	*Activation of relay (X) sets the corresponding bit to 1. Deactivation of relay (0) sets it to 0.*

Byte high: Reserviert **Byte low:** 7654321
bit 1 >> Relay 1
bit 2 >> Relay 2
bit 3 >> Relay 3

Example:	**Value**	**Status**
	1>>	X 0 0
	2 >>	0 X 0
	4 >>	0 0 X
	3 >>	X X 0
	7 >>	X X X

Description	**Digital Inputs+PTC motor**
V5 parameter	G0.6
Data Address	40196
Data type	r (read)
Units	nil
Range	nil
Note :	*The activation of a digital Input (X) sets the corresponding bit to 1. Likewise an input deactivation (0) sets the bit to 0.*

Byte high: Reserviert **Byte low:** 87654321
bit 1 >> Digital Input 1
bit 2 >> Digital Input 2
bit 3 >> Digital Input 3
bit 4 >> Digital Input 4
bit 5 >> Digital Input 5
bit 6 >> PTC Motor

Example:	**Value**	**Status**
	32 >>	0 0 0 0 0 F
	33 >>	X 0 0 0 0 F
	34 >>	0 X 0 0 0 F
	36 >>	0 0 X 0 0 F
	40 >>	0 0 0 X 0 F
	48 >>	0 0 0 0 X F

Description	**Overload Status**
V5 parameter	G0.7
Data Address	40197
Data type	r (read)
Units	%
Range	0..100%, where 100% overload will cause an Overload fault status on the soft-starter.

Description	**Start (Host) Command**
V5 parameter	
Data Address	40198
Data type	r/w (read/write)
Units	nil
Range	0..1
Note :	*If G6.1 control mode =3 serial comms has been enabled, writing a 1 to this register starts the soft starter.*

Description	**Stop (Host) Command**
V5 parameter	
Data Address	40199
Data type	r/w (read/write)
Units	nil
Range	0..1
Note:	*If G6.1 Control model=3 Serial comms has been enabled, writing 1 to this register sends a STOP command to the soft-starter.*

Description	**Reset (Host) Command**
V5 parameter	
Data Address	40200
Data type	r/w (read/write)
Units	nil
Range	0..1
Note:	*If G6.1 Control model=3 Serial comms has been enabled, writing 1 to this register sends a RESET command to the soft-starter.*

Description	**V5 Status**
V5 parameter	
Data Address	40201
Data type	r (read)
Units	nil
Range	nil
Note:	*Digital inputs on (X) causes 1 in the determinated bit*

Byte high: Reserved **Byte Low:** 87654321
bit 1 >> V5 Stopped
bit 2 >> V5 Acelerating
bit 3 >> V5 Running
bit 4 >> V5 Deccelerating

Description	**Fault status**
V5 parameter	G10.1
Data Address	40202
Data type	r (read)
Units	nil
Range	0..27
Note:	*Also this values are displayed In 7 segment PBUS display.*

FAULT	DISPLAY TEST	DESCRIPTION
F0	NO FAULT	No fault.
F1	PHA MISING	Phase input missing.
F2	WRONG PH/SQ	Wrong input phase sequence.
F3	ASYM CURR	Unbalanced current consumption.
F4	OVER LOAD	Excessive current consumption.
F5	UNDER LOAD	Under load motor.
F6	PEAK CURR	The current has been higher than 6 times the nominal.
F7	STARTER OT	Excessive temperature in the radiator (>85ºC).
F8	MOTOR PTC	Shoot by the PTC of the motor.
F9	SHEAR PIN	The motor current has reached the Shearpin protection.
F10	OVER VOLT	Too high input voltage.
F11	UNDER VOLT	Too low input voltage for too much time.
F12	EXCESIV STR	Excessive number of starts.
F13	MEMORY FLT	Fault in data memory.
F14	SCR1 FAULT	Thyristor fault in phase L1, disconnected motor in L1.
F15	SCR2 FAULT	Thyristor fault in phase L2, disconnected motor in L2.
F16	SCR3 FAULT	Thyristor fault in phase L3, disconnected motor in L3.
F17	SCR_S FLT	Thyristor fault, disconnected motor.
F18	EXCES T LS	Too much time at slow speed mode.
F19	LS DISABLE	It's not possible to work at Slow Speed mode.
F20	COMS T/OUT	Too much time without Serial Communications.
F21	EXTRN TRIP	An external fault has occured through a digital input.
F22	CUR FLT	Large current imbalance occurs due to a sudden voltaje

		drop in any of the V5 input phases.
F23	CUR FLT2	Large current imbalance occurs due to a sudden voltaje rise in any of the V5 input phases
F24	HIGH PRESSURE	Overpressure, the V5 is running and the pressure switch opens for longer then the time entered in screen G16.4.
F25	LOW PRESSURE	The V5 is running and the pressure switch opens for longer than the time entered in screen G16.5.
F26	FLOW SWITCH	No water in the pump, then the flow switch is ignored for the time set in screen G16.7 on receip on a valid start signal.
F27	DEEP WELL PROBE	The tank or pump has not water.

Description **V5 Status Mode**
V5 parameter
Data Address 40203
Data type r (read)
Units nil
Range nil

Description **Motor Current**
V5 parameter
Data Address 40204
Data type r (read)
Units % of nominal current of the starter (G.2.1).
Range 0..500%

Description **Motor Power**
V5 parameter
Data Address 40205
Data type r (read)
Units % of nominal power of the starter (G.2.4).
Range 0..??%

Description **Motor Voltage**
V5 parameter
Data Address 40206
Data type r (read)
Units % of nominal voltage of the starter (G.2.3).
Range 0..??%

Description **Analogue input 1**
V5 parameter
Data Address 40207
Data type r (read)
Units %
Range 0..100%

Description **Analogue input 2**
V5 parameter
Data Address 40208
Data type r (read)
Units %
Range 0..100%

Description	**Total Current**
V5 parameter	
Data Address	40209
Data type	r (read)
Units	A
Range	0..9999

Description	**Total Power**
V5 parameter	
Data Address	40210
Data type	r (read)
Units	V
Range	0..999

Parameters Group 1: Menu options

Description	**Commissioning**
V5 parameter	G1.6
Data Address	40019
Data type	r/w (read/write)
Units	nil
Range	0..1 0=NO 1=YES
Note:	*The rest of screens from this gruop can only be modify from local display for security reasons.*

Parameters Group 2: Nameplate

Description	**V5 (nameplate) current**
V5 parameter	G2.1
Data Address	40022
Data type	r/w (read/write)
Units	Amps
Range	0..1600

Description	**Motor (nameplate) Current**
V5 parameter	G2.2
Data Address	40023
Data type	r/w (read/write)
Units	Amps
Range	0..1600

Description	**Motor(nameplate) Voltage**
V5 parameter	G2.3
Data Address	40024
Data type	r/w (read/write)
Units	Volts
Range	0..4 1 = 220V / 240V 2 = 380V / 440V 3 = 460V / 525V 4 = 660V /690V

Description	**Motor(nameplate) Power**
V5 parameter	G2.4
Data Address	40025
Data type	r/w (read/write)
Units	kW
Range	4..999

Description	**Motor(nameplate) Phi Cosine**
V5 parameter	G2.5
Data Address	40026
Data type	r/w (read/write)
Units	nil
Range	40..99%
***Reading example*:**	Comms value 30 =30%

Description	**Mains (nameplate) Frequency**
V5 parameter	G2.6
Data Address	40027
Data type	r/w (read/write)
Units	nil
Range	0= 50Hz 1=50/60Hz

Parameters Group 3: Protections

Description	**Phase Sequence**
V5 parameter	G3.1
Data Address	40029
Data type	r/w (read/write), stop to set
Units	nil
Range	0=No phase Sequence 1= L1 L2 L3 Sequence 2= Inverse Sequence

Description	**Overload Current**
V5 parameter	G3.2
Data Address	40030
Data type	r/w (read/write)
Units	Amps
Range	0.6 to 1.5 x I equip
Scale	200= I equip (intensidad nominal del equipo)
***Reading example*:**	Comms value 300 and current 30A (300 x 30) / 200 = 45A

Description	**Overload Curve**
V5 parameter	G3.3
Data Address	40031
Data type	r/w (read/write)
Units	nil
Range	0..10

Description	**Overload Factor**
V5 parameter	G3.4
Data Address	40032
Data type	r/w (read/write)
Units	% Overload Curve (G3.3)
Range	100..500

Description	**PTC motor**
V5 parameter	G3.5
Data Address	40033
Data type	r/w (read/write), stop to set
Units	nil
Range	0= NO 1= YES

Description	**Underload Current**
V5 parameter	G3.6
Data Address	40034
Data type	r/w (read/write)
Units	Amps
Range	0 to 0.9 x I equip.
Scale	200= I equip
***Reading example*:**	Comms value 180 , current 30A (180 x 30) / 200 = 27A

Description	**Underload Delay**
V5 parameter	G3.7
Data Address	40035
Data type	r/w (read/write)
Units	seconds
Range	0..99, 100=OFF (verify off)

Description	**Shearpin Current**
V5 parameter	G3.8
Data Address	40036
Data type	r/w (read/write)
Units	Amps
Range	0.6 to 1.2 x I equip.
Scale	200= I equip
***Reading example*:**	Comms value 240, current 30A (240 x 30) / 200 = 36A

Description	**Asymetrical Current Protection**
V5 parameter	G3.9
Data Address	40037
Data type	r/w (read/write)
Units	nil
Range	0..1 0 = No 1 = Yes

Description **Low Voltage**
V5 parameter G3.10
Data Address 40038
Data type r/w (read/write)
Units Volts
Range It depends of the motor voltage:

V motor	Range	Scale
220V / 240V	162V – 208V	x 0.5775
380V / 440V	280V - 360V	x 1.0
460V / 525V	350V – 450V	x 1.25
660V / 690V	508V – 653V	x 1.815

Description **Low Voltage time**
V5 parameter G3.11
Data Address 40039
Data type r/w (read/write)
Units seconds
Range 0..10, 11=OFF (verify off)

Description **Overvoltage**
V5 parameter G3.12
Data Address 40040
Data type r/w (read/write)
Units Volts
Range It depends of the motor voltage:

V motor	Range	Scale
220V / 240V	254V – 266V	x 0.5775
380V / 440V	440V - 460V	x 1.0
460V / 525V	550V – 575V	x 1.25
660V / 690V	798V – 835V	x 1.815

Description **Overvoltage Timeout**
V5 parameter G3.13
Data Address 40041
Data type r/w (read/write)
Units seconds
Range 0..10, 11=OFF (verify off)

Description **Starts Limit**
V5 parameter G3.14
Data Address 40042
Data type r/w (read/write)
Units nil
Range 0..10

Description **Start Interval**
V5 parameter G3.15
Data Address Q40043
Data type r/w (read/write)
Units minutes
Range 0..60, 61=OFF (verify off)

Parameters Group 4: Acceleration

Description	**Start Delay**
V5 parameter	G4.1
Data Address	40045
Data type	r/w (read/write)
Units	seg
Range	0..600

Description	**Pulse Torque**
V5 parameter	G4.2
Data Address	40046
Data type	r/w (read/write)
Units	nil
Range	50..100

Description	**Pulse Torque Time**
V5 parameter	G4.3
Data Address	40047
Data type	r/w (read/write)
Units	milliseconds
Range	0..9, OFF

Description	**Initial Torque**
V5 parameter	G4.4
Data Address	40048
Data type	r/w (read/write)
Units	nil
Range	30..99

Description	**Initial Torque Time**
V5 parameter	G4.5
Data Address	40049
Data type	r/w (read/write)
Units	seconds
Range	0..10

Description	**Acceleration Time**
V5 parameter	G4.6
Data Address	40050
Data type	r/w (read/write)
Units	seconds
Range	1..180

Description	**Current Limit**
V5 parameter	G4.7
Data Address	40051
Data type	r/w (read/write)
Units	Amps
Range	1,5..5 x I equip.

Parameters Group 5: Deceleration

Description	**Freewheel Stop**
V5 parameter	G5.1
Data Address	40053
Data type	r/w (read/write)
Units	no
Range	0..1 0 = No 1 = Yes

Description	**Deceleration Time**
V5 parameter	G5.2
Data Address	40054
Data type	r/w (read/write)
Units	seconds
Range	0..180

Description	**Deceleration Algorithm**
V5 parameter	G5.3
Data Address	40055
Data type	r/w (read/write)
Units	no
Range	0..1 0= NORMAL 1=HAMMER ALGORITHM

Description	**Hammer Factor**
V5 parameter	G5.4
Data Address	40056
Data type	r/w (read/write)
Units	%
Range	1..99

Description	**Hammer Torque**
V5 parameter	G5.5
Data Address	40057
Data type	r/w (read/write)
Units	%
Range	1..79

Parameters Group 6: Inputs

Description	**Control Mode**
V5 parameter	G6.1
Data Address	40059
Data type	r/w (read/write), stop to set
Units	nil
Range	0..5

Nr.	MODE	DESCRIPTION	DISPLAY
0	Disable	No control source enabled. There is no way to Start/Stop-Reset the V5.	
1	Local	Start/Stop-Reset enabled by keypad.	L
2	Remote	Start/Stop-Reset enabled by digital inputs.	R
3	Serial Comms	Start/Stop-Reset enabled by serial comms.	C
4	Local Jog V/S	Jog Slow Speed controlled by keypad.	G
5	Pump ctrl-1	Pump control 1 enable.	P

Description **Local Reset**
V5 parameter G6.2
Data Address 40060
Data type r/w (read/write), stop to set
Units nil
Range 0..1
0 = No
1 = Yes

Description **Digital Input 1, 2, 3, 4, 5**
V5 parameter G6.3, 4, 5, 6, 7
Data Address 40061, 40062, 40063, 40064, 40065
Data type r/w (read/write), stop to set
Units nil
Range 0..10

Nr.	MODE	STATUS	FUNCTION
0	Not active	NA	Input has no effect.
1	Start	NO	Commands start.
2	Stop	NC	Commands stop.
3	Stop-Reset	NC	Commands stop; Reset on opening edge.
4	Start-Stop	NO	Commands start when closed; Stop when open.
5	Reset	NC	Reset on opening edge.
6	Slow Speed +	NA	Slow Speed +.
7	Slow Speed -	NA	Slow Speed -.
8	DC Brake	NA	Active DC Brake.
9	Dual setting	NA	Active Dual setting.
10	External trip	NC	Error occurs once this contact is opened.

Description **Analog Input 1 FORMAT**
V5 parameter G6.8
Data Address 40066
Data type r/w (read/write)
Units nil
Range 0..2
0 = 0-20mA;
1 = 4-20mA;
2 = 0-10V

Description	**Analog Input 1 Range**
V5 parameter	G6.9
Data Address	40067
Data type	r/w (read/write)
Units	nil
Range	0..999

Description	**Analog Input 1 Units**
V5 parameter	G6.10
Data Address	40068
Data type	r/w (read/write)
Units	nil
Range	0..3 0 = Bar 1 = º C 2 = Mtr 3 = OFF

Description	**Analog Input 2 Format**
V5 parameter	G6.11
Data Address	40069
Data type	r/w (read/write)
Units	nil
Range	0..2 0 = 0-20mA; 1 = 4-20mA; 2 = 0-10V

Description	**Analog Input 2 Range**
V5 parameter	G6.12
Data Address	40070
Data type	r/w (read/write)
Units	nil
Range	0..999

Description	**Analog Input 2 Units**
V5 parameter	G6.13
Data Address	40069
Data type	r/w (read/write)
Units	nil
Range	0..3 0 = Bar; 1 = º C; 2 = m 3 = OFF

Parameters Group 7: Outputs

Description	**Output Relays 1, 2, 3**
V5 parameter	G7.1, 2, 3
Data Address	40073, 40074, 40075
Data type	r/w (read/write), set to stop
Units	nil
Range	1..21

RELAY TABLE SELECTION		
MODE	**FUNCTION**	**DESCRIPTION**
0	Not active	Relay is disable, not used.
1	Active	Relay is enabled.
2	Warning overload	The motor current exceeds the value adjusted in parameter G3.2 (OVERLOAD CURRENT).
3	Warning under load	The motor current is below the value adjusted in parameter G3.6 (UNDERLOAD CURRENT).
4	Warning over voltage	The mains voltage is equal or higher than G3.12 (OVERVOLTAGE).
5	Warning low voltage	The mains voltage is less or equal than G3.10 (UNDERVOLTAGE).
6	Comparator 1	Relay enables when the value of the parameter set in screen G9.1 is above screen G9.2 value after time set in screen G9.4. Relay disables when the value of the parameter set in screen G9.1 is below screen G9.3 value after time set in screen G9.5.
7	Comparator 2	Relay enables when the value of the parameter set in screen G9.6 is above screen G9.7 value after time set in screen G9.9. Relay disables when the value of the parameter set in screen G9.6 is below screen G9.8 value after time set in screen G9.10.
8	Comparator 3	Relay enables when the value of the parameter set in screen G9.11 is above screen G9.12 value after time set in screen G9.14. Relay disables when the value of the parameter set in screen G9.11 is below screen G9.13 value after time set in screen G9.15.
9	General Fault	Relay will be active a fault occurs.
10	No fault	Will be active if no faults are present (failsafe).
11	Thyristor fault	One or more thyristors are fault.
12	Autoreset Fault	Relay enables when screen G15.2 Attemp numbr setting is passed over.
13	Ready	The soft starter is ready to run the motor.
14	Run	ON at the beginning of the ramp up / OFF at the end of the ramp down.
15	Bypass/React	ON at the end of the ramp up / OFF at the beginning of the ramp down.
16	Delay	ON at the end of the ramp up / OFF at the end of the ramp down.
17	High pressure	The V5 is running and the pressure switch opens for longer than the time entered in screen G16.4
18	Low pressure	The V5 is running and the pressure switch opens for longer than the time entered in screen G16.5.
19	No flow	The flow switch is ignored for the time set in screen G16.6 on receipt of a valid start signal. After this time the V5 will trip if no flow is indicated for longer than the time set in screen G16.7.
20	Low water	The well probe controller (or other level controller) detects a lack of water.
21	Pump fault	A fault from F24 to F27 and F5 has occurred. Pump related faults.

Description **Analog Output Source Selection**
V5 parameter G7.4
Data Address 40076
Data type r/w (read/write), stop to set
Units nil
Range 0..7

Nr.	DESCRIPTION
0	UNUSED
1	MOTOR CURRENT
2	MOTOR POWER
3	MOTOR TORQUE
4	COSINUS PHI
5	INPUT VOLTAGE
6	ANALOG I 1 ECHO
7	ANALOG I 2 ECHO

Description **Analog Output Format**
V5 parameter G7.5
Data Address 40077
Data type r/w (read/write)
Units nil
Range 0..1
0 = 0 - 20mA
1 = 4 - 20mA

Description **Analogue Output Low Setpoint**
V5 parameter G7.6
Data Address 40078
Data type r/w (read/write)
Units % of base selected (G7.5)
Range 0..500

Description **Analogue Output High Setpoint**
V5 parameter G7.7
Data Address 40079
Data type r/w (read/write)
Units % of base selected (G7.5)
Range 0..500

Parameters Group 8: Dual setting

Description **Dual setting**
V5 parameter G8.1
Data Address 40081
Data type r/w (read/write) stop to set
Units no
Range 0 = NO
1 = YES

Description	**Torque pulse 2**
V5 parameter	G8.2
Data Address	40082
Data type	r/w (read/write) stop to set
Units	no
Range	50..100

Descripción	**Pulse torque time 2**
V5 parameter	G8.3
Data Address	40083
Data type	r/w (read/write)
Units	seconds
Range	0..9, 0 = OFF
Scale	/10
***Reading example*:**	Comms value 8 = 0.8 sec

Description	**Initial torque 2**
V5 parameter	G8.4
Data Address	40084
Data type	r/w (read/write)
Units	%
Range	30..99

Description	**Initial torque time 2**
V5 parameter	G8.5
Data Address	40085
Data type	r/w (read/write)
Units	seconds
Range	0..10

Description	**Acceleration time 2**
V5 parameter	G8.6
Data Address	40086
Data type	r/w (read/write)
Units	segundos
Range	1..180

Description	**Current limit 2**
V5 parameter	G8.7
Data Address	40087
Data type	r/w (read/write)
Units	Amps
Range	1,5 a 5 x I equip
Scale	200= I equipo (intensidad nominal del equipo)
***Reading example*:**	Comms value 735 , current 30A (735 x 30) / 200 = **110.25A**

Description	**Freewheel stop 2**
V5 parameter	G8.8
Data Address	40088
Data type	r/w (read/write)
Units	no
Range	0 = NO 1 = YES

Description	**Deceleration time 2**
V5 parameter	G8.9
Data Address	40089
Data type	r/w (read/write)
Units	seconds
Range	1..180

Description	**Motor deceleration algorithm 2**
V5 parameter	G8.10
Data Address	40090
Data type	r/w (read/write)
Units	no
Range	1= NORMAL 2 = HAMMER PREVENT

Description	**Hammer factor 2**
V5 parameter	G8.11
Data Address	40091
Data type	r/w (read/write)
Units	%
Range	1..99

Description	**Minimum torque 2**
V5 parameter	G8.12
Data Address	40092
Data type	r/w (read/write)
Units	%
Range	1..99

Description	**Phase sequence 2**
V5 parameter	G8.13
Data Address	40093
Data type	r/w (read/write), stop to set
Units	no
Range	1 = NO SEQ PROTEC 2 = L1 L2 L3 SEQ 3 = INVERSED SEQ.

Description	**Overload motor current 2**
V5 parameter	G8.14
Data Address	40094
Data type	r/w (read/write)
Units	Amps
Range	0.6 x I equip to 1.5 x I equip
Scale	200= V5 Current
***Reading example*:**	Comms value 300, current 30A (300 x 30) / 200 = 45A

Description	**Overload curve 2**
V5 parameter	G8.15
Data Address	40095
Data type	r/w (read/write)
Units	no
Range	1..10

Description	**Starting overload factor 2**
V5 parameter	G8.16
Data Address	40096
Data type	r/w (read/write)
Units	% overload curve (G3.3)
Range	100..500

Description	**Motor PTC 2**
V5 parameter	G8.17
Data Address	40097
Data type	r/w (read/write), stop to set
Units	no
Range	0= NO 1= YES

Description	**Underload current 2**
V5 parameter	G8.18
Data Address	40098
Data type	r/w (read/write)
Units	Amps
Range	0 a 0.9 x I equip
Scale	200= V5 current
***Reading example*:**	Comms value 180, current 30A

Description	**Underload delay 2**
V5 parameter	G8.19
Data Address	40099
Data type	r/w (read/write)
Units	seconds
Range	0..99, 100=OFF

Description	**Shearpin current 2**
V5 parameter	G8.20
Data Address	40100
Data type	r/w (read/write)
Units	Amps
Range	0.6 x I equip. to 1.2 x I equip.
Scale	200= V5 current
***Reading example*:**	Comms value, current 30A (240 x 30) / 200 = 36A

Description	**Asymmetrical current 2**
V5 parameter	G8.21
Data Address	40101
Data type	r/w (read/write)
Units	no
Range	0..1 0 = NO 1 = YES

Description	**Motor Current 2**
V5 parameter	G8.22
Data Address	40102
Data type	r/w (read/write)
Units	Amps
Range	1 to 1600

Description	**Motor Voltage 2**
V5 parameter	G8.23
Data Address	40103
Data type	r/w (read/write)
Units	Volts
Range	1 = 220V / 240V 2 = 380V / 440V 3 = 460V / 525V 4 = 660V / 690V

Description	**Motor Power 2**
V5 parameter	G8.24
Data Address	40104
Data type	r/w (read/write)
Units	kW
Range	4..999
***Write example*:**	Comms value 41 = 4.1kW

Description	**Motor Cos Phi 2**
V5 parameter	G8.25
Data Address	40105
Data type	r/w (read/write)
Units	no
Range	40..99
***Write example*:**	Comms value 30 = 30%

Description	**Supply frequency 2**
V5 parameter	G8.26
Data Address	40106
Data type	r/w (read/write)
Units	no
Range	0= 50Hz 1=50/60Hz

Parameters Group 9: Comparators

Description	**Comparator Source Selection**
V5 parameter	G9.1
Data Address	40108
Data type	r/w (read/write)
Units	nil
Range	0..8

Nr.	SOURCE
0	UNUSED
1	MOTOR CURRENT
2	MOTOR POWER
3	MOTOR TORQUE
4	COSINUS PHI
5	INPUT VOLTAGE
6	ANALOG INPUT 1
7	ANALOG INPUT 2
8	O/LOAD STATUS

Description	**Comparator ON Setpoint**
V5 parameter	G9.2
Data Address	40109
Data type	r/w (read/ write)
Units	% of function selected (G9.2)
Range	0..500

Description	**Comparator OFF Setpoint**
V5 parameter	G9.3
Data Address	40110
Data type	r/w (read/write)
Units	% of function selected (G9.2)
Range	0..500

Description	**Comparator ON Delay**
V5 parameter	G9.4
Data Address	40111
Data type	r/w (read/write)
Units	seconds
Range	0..99

Description	**Comparator OFF Delay**
V5 parameter	G9.5
Data Address	40112
Data type	r/w (read/write)
Units	seconds
Range	0..99

Description	**Comparator 2 Source Selection**
V5 parameter	G9.6
Data Address	40113
Data type	r/w (read/write)
Units	nil
Range	0..8 (See table G9.1)

Description	**Comparator 2 ON Setpoint**
V5 parameter	G9.7
Data Address	40114
Data type	r/w (read/ write)
Units	% of function selected
Range	0..500

Description	**Comparator 2 OFF Setpoint**
V5 parameter	G9.8
Data Address	40115
Data type	r/w (read/write)
Units	% of function selected
Range	0..500

Description	**Comparator 2 ON Delay**
V5 parameter	G9.9
Data Address	40116
Data type	r/w (read/write)
Units	seconds
Range	0..99

Description	**Comparator 2 OFF Delay**
V5 parameter	G9.10
Data Address	40117
Data type	r/w (read/write)
Units	seconds
Range	0..99

Description	**Comparator 3 Source Selection**
V5 parameter	G9.11
Data Address	40118
Data type	r/w (read/write)
Units	nil
Range	0..8 (See table G9.1)

Description	**Comparator 3 ON Setpoint**
V5 parameter	G9.12
Data Address	40119
Data type	r/w (read/ write)
Units	% of function selected
Range	0..500

Description	**Comparator 3 OFF Setpoint**
V5 parameter	G9.13
Data Address	40120
Data type	r/w (read/write)
Units	% of function selected
Range	0..500

Description	**Comparator 3 ON Delay**
V5 parameter	G9.14
Data Address	40121
Data type	r/w (read/write)
Units	seconds
Range	0..99

Description	**Comparator 2 OFF Delay**
V5 parameter	G9.15
Data Address	40122
Data type	r/w (read/write)
Units	seconds
Range	0..99

Parameters Group 10: Fault Screens

Description	**Last Fault Screen: Displays fourth, third, second & first fault**
V5 parameter	G10.1, 2, 3, 4, 5
Data Address	40124, 40125, 40126, 40127, 40128
Data type	r(read)
Units	nil
Range	0..27 **(See table 12, p.71- MT0001E_ English)**

Description	**Clear History Fault**
V5 parameter	G10.6
Data Address	40129
Data type	r/w (read/write)
Units	nil
Range	0..1 0 = No 1 = Yes

Parameters Group 11: Statistics

Description	**Total number of starts 10k**
V5 parameter	G11.1
Data Address	40131
Data type	r(read)
Units	nil
Range	0..9999
***Note*:**	*Total number of starts =10.000 x (Total of nº starts 10K + Total of nº starts).*

Description	**Total number of starts**
V5 parameter	G11.1
Data Address	40132
Data type	r(read)
Units	no
Range	0..9999

Description	**Partial number of starts 10k**
V5 parameter	G11.2
Data Address	40133
Data type	Only read
Units	nil
Range	0..9999
***Note*:**	*Total number of starts =10.000 x (Total of nº starts 10K + Total of nº starts).*

Description	**Partial Number of Starts**
V5 parameter	G11.2
Data Address	40134
Data type	r(read)
Units	nil
Range	0..9999

Description	**Reset Partial Number of Starts**
V5 parameter	G11.3
Data Address	40135
Data type	r/w (read/write)
Units	nil
Range	0/1 0 = No; 1 = Yes

Description	**Total Working Hours 10k**
V5 parameter	G11.4
Data Address	40136
Data type	r(read)
Units	nil
Range	0..9999
***Note*:**	*Total number of starts =10.000 x (Total of nº starts 10K + Total of nº starts).*

Description	**Total working hours**
V5 parameter	G11.4
Data Address	40137
Data type	r(read)
Units	nil
Range	0..9999

Description	**Partial of working hours 10k**
V5 parameter	G11.5
Data Address	40141
Data type	r(read)
Units	nil
Range	0..9999
***Note*:**	*Total number of starts =10.000 x (Total of nº starts 10K + Total of nº starts).*

Description	**Partial of working hours**
V5 parameter	G11.5
Data Address	40142
Data type	r(read)
Units	nil
Range	0..9999

Description	**Clear Partial of Working Hours**
V5 parameter	G11.6
Data Address	40144
Data type	r/w (read/write)
Units	nil
Range	0/1 0 = No; 1 = Yes

Description	**Total Faults**
V5 parameter	G11.7
Data Address	40145
Data type	r(read)
Units	nil
Range	0..9999

Description	**Partial of Faults**
V5 parameter	G11.8
Data Address	40146
Data type	r(read)
Units	nil
Range	0..9999

Description	**Del Partial**
V5 parameter	G11.9
Data Address	40147
Data type	r/w (read/write)
Units	nil
Range	0/1 0 = No; 1 = Yes

Description	**Total Kw/h Counter**
V5 parameter	G11.10
Data Address	40148
Data type	r/w (read/write)
Units	kw/h
Range	0..9999

Description	**Total 10k Kw/h (*)Counter**
V5 parameter	G11.10
Data Address	40149
Data type	r/w (read/write)
Units	kw/h
Range	0..9999

***(*) Note: All parameters including** 10k are the high word of a 2 word set ,to read correctly these registers the following calculation must be done 10. 000 * (10K register value) = High word total register = Value (high word) + Value(low word).*

Parameters Group 12: Slow Speed

Description	**Slow speed mode**
V5 parameter	G12.1
Data Address	40151
Data type	r/w (read/write), stop to set
Units	nil
Range	0/1 0 = No; 1 = Yes

Description	**Slow Speed Torque**
V5 parameter	G12.2
Data Address	40152
Data type	r/w (read/write)
Units	%, over nominal pair of the motor
Range	30..99

Description	**Slow Speed Timeout**
V5 parameter	G12.3
Data Address	40153
Data type	r/w (read/write)
Units	%, over nominal pair of the motor
Range	0..60

Description	**Slow Speed Acceleration Time**
V5 parameter	G12.4
Data Address	40154
Data type	r/w (read/write)
Units	seconds
Range	0..60, OFF

Description	**Slow Speed Deceleration Time**
V5 parameter	G12.5
Data Address	40155
Data type	r/w (read/write)
Units	seconds
Range	0..60, OFF

Parameters Group 13: DC-Brake

Description	**DC Brake Selection**
V5 parameter	G13.1
Data Address	40159
Data type	r/w (read/write), stop to set
Units	no
Range	0/1 0 = No; 1 = Yes

Description	**DC Current**
V5 parameter	G13.2
Data Address	40160
Data type	r/w (read/write)
Units	%, of nominal current of motor
Range	30..99

Description	**DC Time**
V5 parameter	G13.3
Data Address	40161
Data type	r/w (read/write)
Units	seconds
Range	0..99

Description	**External Brake**
V5 parameter	G13.4
Data Address	40162
Data type	r/w (read/write)
Units	nil
Range	0/1 0 = No; 1 = Yes

Parameters Group 14: Serial Communication

Description	**Serial Communications Timeout**
V5 parameter	G14.1
Data Address	40165
Data type	r/w (read/write)
Units	seconds
Range	1..25, (verification OFF)

Description	**ModBus Address**
V5 parameter	G14.2
Data Address	40166
Data type	r/w (read/write)
Units	nil
Range	0..240

Description	**ModBus Baud rate**
V5 parameter	G14.3
Data Address	40167
Data type	r/w (read/write)
Units	no
Range	0..5 0 = 0; 1 = 1200; 2 = 2400; 3 = 4800; 4 = 9600; 5 = OFF

Description	**Even Parity**
V5 parameter	G14.4
Data Address	40168
Data type	r/w (read/write)
Units	no
Range	0/1 0 = No parity; 1 = Pair parity

Parameters Group 15: Auto Reset .

Description	**Auto reset**
V5 parameter	G15.1
Data Address	40170
Data type	r/w (read/write)
Units	no
Range	0 = No 1 = Yes

Description	**Attempt number**
V5 parameter	G15.2
Data Address	40171
Data type	r/w (read/write)
Units	no
Range	1..5

Description	**Reset delay time**
V5 parameter	G15.3
Data Address	40172
Data type	r/w (read/write)
Units	no
Range	5..120

Description	**Reset time**
V5 parameter	G15.4
Data Address	40173
Data type	r/w (read/write)
Units	no
Range	1..60

Description	**F1 auto RST, F2 auto RST, F3 auto RST, F4 auto RST**
V5 parameter	G15.5, 6, 7, 8
Data Address	40174, 40175, 40176, 40177
Data type	r/w (read/write)
Units	no
Range	0 .. 20

FAULT	FAULT LIST
0	0 NO AUTO RESET
1	1 PHAS MISING
2	2 WRONG PH/SQ
3	3 ASYM CURR
4	4 OVER LOAD
5	5 UNDER LOAD
6	6 STARTER OVT
7	7 MOTOR PTC
8	8 SHEAR PIN
9	9 OVER VOLT
10	10 UNDER VOLT
11	11 SCR_1 FAULT
12	12 SCR_2 FAULT
13	13 SCR_3 FAULT
14	14 SCR_S FLT
15	15 EXCESIV LS T
16	16 COMMS T/OUT
17	17 EXTERN TRIP
18	18 CUR FLT
19	19 CUR2 FLT
20	20 ALL THE FLTS

Parameters Group 16: Pump control 1.

Description	**Irrigation time setting**
V5 parameter	G16.1
Data Address	40212
Data type	r/w (read/write)
Units	hours
Range	0 to 60 h

Description	**Irrigation time display**
V5 parameter	G16.2
Data Address	40213
Data type	r/w (read/write)
Units	hours
Range	0 to 60 h

Description	**Start mode selection**
V5 parameter	G16.3
Data Address	40214
Data type	r/w (read/write)
Units	no
Range	0 = Display unit 1 = 2 Wire

Description	**High pressure timeout**
V5 parameter	G16.4
Data Address	40215
Data type	r/w (read/write)
Units	seconds
Range	0 to 60

Description	**Low pressure timeout**
V5 parameter	G16.5
Data Address	40216
Data type	r/w (read/write)
Units	seconds
Range	0 a 3600

Description	**Low pressure Bypass time**
V5 parameter	G16.6
Data Address	40217
Data type	r/w (read/write)
Units	seconds
Range	0 a 1800

Description	**No flow Bypass time**
V5 parameter	G16.7
Data Address	40218
Data type	r/w (read/write)
Units	seconds
Range	0 to 1800

Description	**No flow debounce time**
V5 parameter	G16.8
Data Address	40219
Data type	r/w (read/write)
Units	seconds
Range	0 to 60

Description	**Deep well probe Bypass timer**
V5 parameter	G16.9
Data Address	40220
Data type	r/w (read/write)
Units	seconds
Range	0 to 60

5. ADDRESSING MODES.

5.1 Broadcast addressing mode.

Broadcast addressing mode allows master to access at the same time to all slaves connected to the ModBus net.

Broadcast addressing mode which admits this global addressing mode is:

Function 16 **Registers writing.**

In order to access to all soft-starters in a ModBus net, address zero (0) should be used. When this address is used, all slaves in ModBus net make the required task but they do not prepare any answer.

5.2 Groupcast addressing mode.

Groupcast addressing mode allows master to access at the same time to a group of slaves connected to the ModBus net.

The ModBus function code which admits this group addressing mode is:

Function 16 **Registers writing.**

In order to access to different soft-starters groups in a ModBus net, a special addressing system is used. This system obtains the linked group address starting from individual addresses.

In the following table the corresponding between individual addresses and linked group address is shown.

GROUP	INDIVIDUAL ADDRESS	GROUP ADDRESS	GLOBAL ADDRESS
Group 1	1..6	241	0
Group 2	17..32	242	0
Group 3	33..48	243	0
Group 4	49..64	244	0
Group 5	65..80	245	0
Group 6	81..96	246	0
Group 7	97..112	247	0
Group 8	113..128	248	0
Group 9	129..144	249	0
Group 10	145..160	250	0
Group 11	161..176	251	0
Group 12	177..192	252	0
Group 13	193..208	253	0
Group 14	209..224	254	0
Group 15	225..240	255	0

Table 4.1 V5 soft-starters communication addresses

ANNEX A. PHYSICAL LEVEL

V5 soft-starter can be physically connected to a RS485 net, where more equipments cohabit, by means of a twisted wire.

RS232 hardware has two separate lines, one of them for receiving (Rx) and the other one for transmitting (Tx). This allows RS232 net to work in full duplex mode. Full duplex means master is able of transmitting and receiving data simultaneously.

RS485 hardware used in V5 soft-starter uses the same twisted wire for receiving (Rx) and for transmitting (Tx) and that allows RS485 system to work only in half duplex. Half duplex means master is able of transmitting or receiving data, but no simultaneously. In order to control information flow through a half duplex system in a RS232 net, the normally used line is Request – To – Send (RTS) line.

ANNEX B. MODBUS COMMUNICATION PROTOCOL.

B.1 FRAMING RTU

In framing RTU, data are transmitted and received like 8 bits sequences. When a 16 bits register is wanted to be transmitted, it is divided in to two parts of 8 bits, transmitting first the most significant byte. If more than 3.5 byte periods are lapsed between characters reception, soft-starter will understand that the following received byte belongs to a different frame and will considered the current frame finished.

B.2 ADDRESSES FIELD

Addresses field has a 8 bits length and allows to address 1-240 individual addresses, 241-255 group addresses, and one (0) broadcast address.
Each V5 soft-starter identifies itself by unequivocal way with an address that master uses when communications must be established.
All V5 soft-starter recognise and execute messages with groupcast addresses, but they do not answer master with a confirmation.

B.3 FUNCTION FIELD

Function field indicates to the addressed equipment task to be done. When slave detects a communication failure, most significant bit of this field is set to one in order to indicate to the master the no normal situation. In point B.6 you can get additional information about exception codes.

B.4 DATA FIELD

Data field is used for transmitting information to and from addressed slaves. Data field length is 16 (or multiple) bits length (transmitted in 2 bytes, first most significant).

B.5 CYCLICAL REDUNDANT CODE

Cyclical redundant code is used as much for the master as for the slave in order to detect failures in transmitting. This code is added at the end of transmitted frame. The characteristic polynomial of this code is:

$$CRC - 16 = x^{16} + x^{15} + x^{2} + 1$$

Receiver calculates the CRC of received message and compares it with received cyclical redundant code. In case of failure, the complete message is rejected. It is no possible to recover failures inside of this message.

Theory.
All the message (without start / stop and parity bits) is consider like a continuous sequence to be processed with most significant bit transmitted at first place. The message is pre-multiplied per 2^16 (2 bytes to the left) and then it is divided by polynomial shown above. The quotient is discarded and the rest of 16 bits is added to the message. This rest is pre-initialized to 0FFFFH in order to avoid the acceptance of a zeros sequence like a valid sequence.

Receiver receives the whole sequence and makes the division using the same characteristics polynomial: in case of received message has no error, the rest of division is zero.

The device used for data series transmission will send the less significant bit LSB of each character first of all. When the CRC should be generated, the first transmitted bit is defined like most significant bit MSB of dividend. By convenience, and due to no haulage in this arithmetic, it is assumed that most significant bit MSB is the one on the right. For that, if we want to be consistent, bit order of characteristic polynomial should be inverted. Most significant bit is discarded just because it affects only to quotient and no to rest. At the end, the original polynomial x^16+x^15+x^2+1 = 1100 0000 0000 00101 left in this way 1010 0000 0000 0001 (A001H).

B.6 EXCEPTION CODES

So much protocol errors like range data errors cause a response of V5 soft-starter with an exception response.

A exception response consist of the slave address which has detected the failure, the function code received by the slave (with most significant bit set to 1 in order to indicate an exception response), the error code and the cyclical redundant code.

In the following table the exception codes and their causes are summarized:

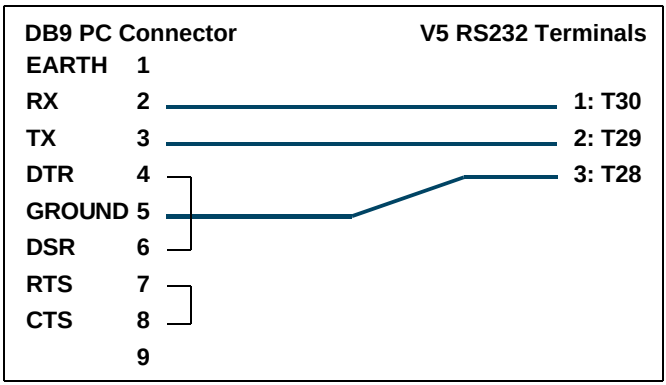
CODE	NAME	CAUSE
01	Illegal function	Function field received by slave is out of range. Valid range for function code is code 3 and 16.
02	Illegal data address	Data address received by the slave is out of range.
03	Illegal data value	Data value received by the slave is out of range.
06	Occupied, rejected message	Slave can not achieve the required task by master in an immediate way.
07	Acknowledge	The required task can not be carried out.

ANNEX C. TIPICAL CONNECTION DRAWING

Typical connection drawing.

Pin out and connections for multiplexer bridge Modicon BM85 to communications port RS232. This pin out is also applicable to 9 pins output connector in compatible IBM computers.

CONNECTOR		CONECTION
1	-	Chassis.
2	IN	RX.
3	OUT	TX.
4	OUT	DTR (Data Terminal Ready).
5	-	Earth signal.
6	IN	DSR (Data Set Ready).
7	OUT	RST (Request To Send).
8	IN	CTS (Request To Send).
9	-	Not Connected.



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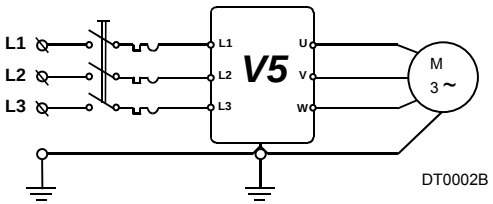

DT0002B

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