freemaq®
ACTIVE HARMONIC FILTER

Active Filter

Programming and Software Manual

POWER ELECTRONICS®

Active Filter

Programming and Software Manual

FQA_R1.0

Edition: March 2014

FQAMTSW01AI Rev. A

ESPAÑOL

SAFETY SYMBOLS

Always follow safety instructions to prevent accidents and potential hazards from occurring.

 **WARNING**	This symbol means improper operation may results in serious personal injury or death.
 **CAUTION**	Identifies shock hazards under certain conditions. Particular attention should be given because dangerous voltage may be present. Maintenance operation should be done by qualified personnel
	Identifies potential hazards under certain conditions. Read the message and follow the instructions carefully.
	Identifies shock hazards under certain conditions. Particular attention should be given because dangerous voltage may be present.

Edition of March 2014

This publication could present technical imprecision or misprints. The information here included will be periodically modified and updated, and all those modifications will be incorporated in later editions. To consult the most updated information of this product you might access through our website www.power-electronics.com where the latest version of this manual can be downloaded.

Revisions

Date	Revision	Description
13 / 03 / 2014	A	First Edition - SW Version R1.0

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E S P A Ñ O L

SAFETY INSTRUCTIONS

IMPORTANT!

- Read this manual carefully to maximize the performance of this product and to ensure its safe use.
- Power Electronics accepts no responsibility or liability for any damage resulting from inappropriate use of the equipment.
- In this manual, safety messages are classified as follows:

ALARMA

Do not remove the metal cover while the power is applied or the unit is in operation.
Otherwise electric shock could occur.

Do not run the drive with the front cover removed.
Otherwise, you may get an electric shock due to the high voltage terminals or exposure of charged capacitors.

The filter does not disconnect the terminals of the power supply. Before manage the equipment, turn off the power supply.

Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied.
Otherwise, you may access to the charged circuits and may get an electric shock.

Wiring and periodic inspections should be performed at least 10 minutes after disconnecting the input power. To remove the front cover check that the DC Link red LED is off, then remove the terminals metallic cover and check with a multimeter the following measures:

- **Measure that the DC link terminals +, - and chassis voltage are below 30VDC.**

Otherwise, you may get an electric shock.

Operate the switches with dry hands.
Otherwise, you may get an electric shock.

Do not use cables with damaged insulation.
Otherwise, you may get an electric shock.

Do not subject the cables to abrasions, excessive stress, heavy loads or pinching.
Otherwise, you may get an electric shock.

CAUTION

Install the filter on a non-flammable surface. Do not place flammable material nearby. Otherwise fire could occur.

Disconnect the input power if the drive is damaged. Otherwise, it could result in a secondary accident or fire.

After stopping the filter, it will remain hot for a couple of minutes. Touching hot parts may result in skin burns.

Do not apply power to a damaged filter or to a drive with parts missing even if the installation is complete. Otherwise, you may get an electric shock.

It is not permitted to weld the cabinet; this can damage the electronic sensitive equipment inside.

Do not allow lint, paper, wood chips, dust, metallic chips or other foreign matter into the filter. Otherwise fire or accident could occur.

WARNINGS

RECEPTION

- The FQA series are carefully tested and perfectly packed before delivering.
- In the event of transport damage, please ensure that you notify the transport agency and POWER ELECTRONICS: 902 40 20 70 (International +34 96 136 65 57) or your nearest agent, within 24hrs from receipt of the goods.

UNPACKING

- Make sure model and serial number are the same on the box, delivery note and unit.
- Each variable speed drive is delivered with Hardware and Software technical manuals.

RECYCLING

- Packing of the equipments should be recycled. For this, it is necessary to separate different materials included (plastic, paper, cardboard, wood ...) and deposit them on proper banks.
- Waste products of electric and electronic devices should be selectively collected for your correct recycling company.

SAFETY

- Before operating the drive, read this manual thoroughly to gain and understanding of the unit. If any doubt exists then please contact POWER ELECTRONICS, (902 40 20 70 / +34 96 136 65 57) or your nearest agent.
- Wear safety glasses when operating the equipment with power applied or the front cover is removed.
- Handle and transport the filter following the recommendations within this manual.
- Install the filter according to the instructions within this manual and the local regulations.
- Do not place heavy objects on the filter.
- Ensure that the filter is mounted vertically and keeping the minimum clearances distances. Do not drop the filter or subject it to impact.
- The FQA filters contain static sensitive printed circuits boards. Use static safety procedures when handling these boards.
- Avoid installing the filter in conditions that differ from those described in the *Environmental Ratings* section.

CONNECTION PRECAUTIONS

- To ensure correct operation of the filter it is recommended to use a SCREENED CABLE for the control wiring.
- Always check whether the DC Link red LED is OFF before wiring terminals. The capacitors may hold high-voltage even after the input power is disconnected.
- Do not connect the filter into grids with THDv higher than 8%.

COMMISSIONING

- Verify all parameters during the operation. The change of the parameters value depends on the charge and the application.
- Applied voltage and current levels as internal signs in terminals may be suitable for the data provided in this manual.

OPERATION PRECAUTIONS

- If a fault is reset with the reference signal still active, the drive will unexpectedly restart. Verify that it is permissible for this to happen. Otherwise, it may lead to injury to people.
- Do not modify or alter internal wiring and spare parts without Power Electronics supervision.
- Before programming or operating, initialize all parameters back to factory default values.

EARTH CONNECTION

- Ground the filter and adjoining cabinets to ensure a safety operation and to reduce electromagnetic emission.
- Connect the input PE terminal only to the dedicated PE terminal of the filter. Do not use the case or the chassis screw for grounding.
- Ground the filter chassis through the dedicated and labelled terminals. Use appropriate conductors to comply with the local regulations. The ground conductor should be connected first and removed last.

E S P A Ñ O L

1. DISPLAY UNIT AND CONTROL KEYPAD

1.1. Keypad Unit Description

The display of the FQA series is removable for remote installation, as the illustration shows. There are three leds on the display which indicate the drive operational status, one LCD screen with 4 lines of 16 characters each and keys for control and parameter setting.

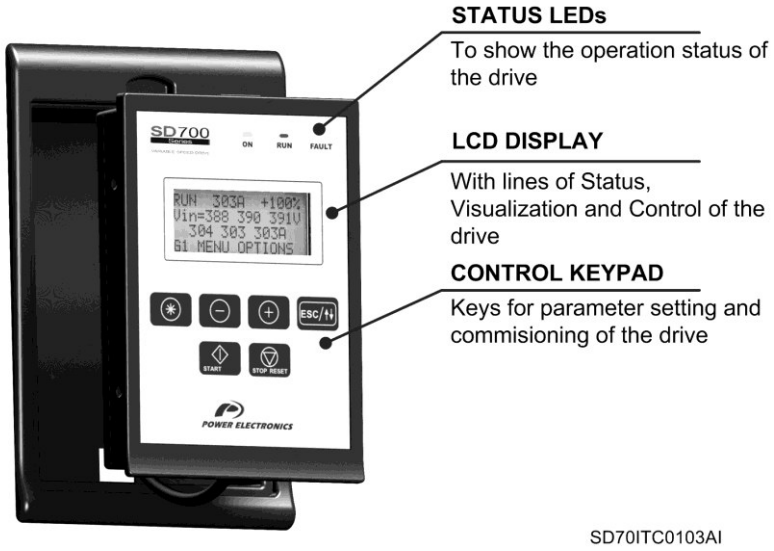


Figure 1.1 Display Unit and Keypad

1.1.1. LEDs for Status Indication

Leds offer an easy method of identifying if the FQA is powered up, if the filter is supplying output voltage, or if the filter has tripped.

- **Led ON**: Yellow colour. When it is lit, indicates equipment is powered up.
- **Led RUN**: Green colour. When it is lit, indicates the filter is operating.
- **Led FAULT**: Red colour. When it is blinking, indicates the equipment is in fault status.

Figure 1.2 Status Visualization

1.1.2. Alphanumeric LCD Display

FQA series display has a LCD screen of four lines with sixteen characters each (16x4). Each line has different functions.

- **Status Line:** It is the top line.
It is always present and shows the FQA status (STR – Start, STP – Stop, etc…).
It also shows the output current and the motor speed.
It is not configurable by the user.

- **Visualization Line 1:** It is the second line of the screen. It is always present and allows the selection of variables from the visualization menu.
It is configurable by the user.

- **Visualization Line 2:** It is the third line of the screen. It is always present and allows the selection of variables from the visualization menu.
It is configurable by the user.

- **Programming Line:** it is the fourth line
It is used to display and / or set different parameters within the FQA.

Figure 1.3 Detail of Display Lines

1.1.3. Control Keys

Function keys have multiple uses and can be operated individually or in combination with other keys:

It allows access to different parameters groups and sub-groups; it displays code explanations and allows adjustment of parameter values in combination with other keys. If a group has no sub-groups, it allows direct access to the parameters of the group.

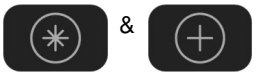
To modify numeric parameters:

Simultaneously pushed, the value will increase.

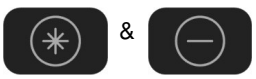
Simultaneously pushed, the value will decrease.

To modify parameters of numbered options:

Pushing this key, the extended explanation will appear.



Simultaneously pushed will ascend the user through the varying options.



Simultaneously pushed will descend the user through the varying options.

It allows upward movement through the parameters groups and allows navigation for different parameters within a parameter group. It also allows the increase of parameters value.

It allows downward movement through the parameters groups and allows navigation for different parameters within a parameter group. It also allows the decrease of parameters value.

When pushed for 2 seconds (approx.) it allows navigation between the programming line and visualisation lines available to the user. It also offers the possibility of escaping back to the previous sub-group or group.

To start the drive from the keypad when the control has been set as local control (check drive configuration).

To stop the filter from the keypad when the control has been set as local control. In the case of tripping this key can be used to reset the filter, if local control is enabled. The drive will not perform an Emergency Stop and the filter will not be disconnected from the power supply.

In the following figure you can see a programming example where you can observe the operation explained previously.

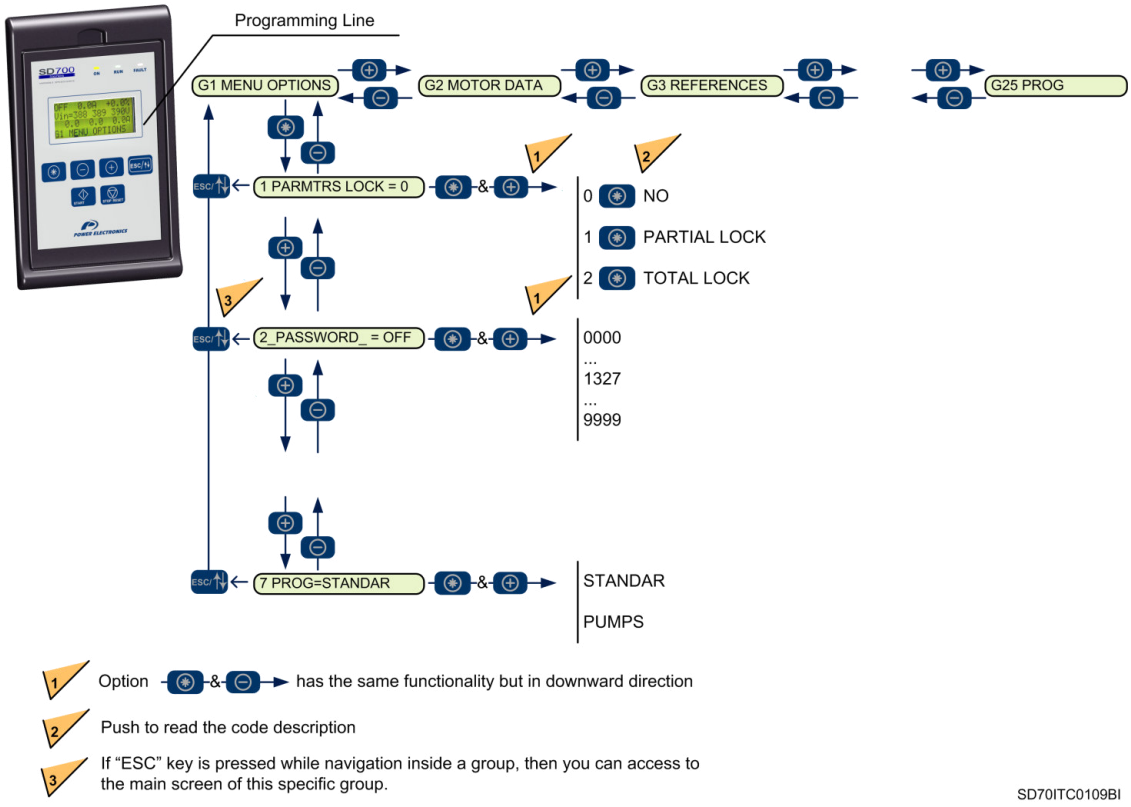


Figure 1.4 Example of parameters navigation

2. STATUS MESSAGES

The upper line of the display corresponds to the status line. In this line we can display the equipment status, motor current (A) and the motor speed (%). It is always displayed and it is not programmable by the user.

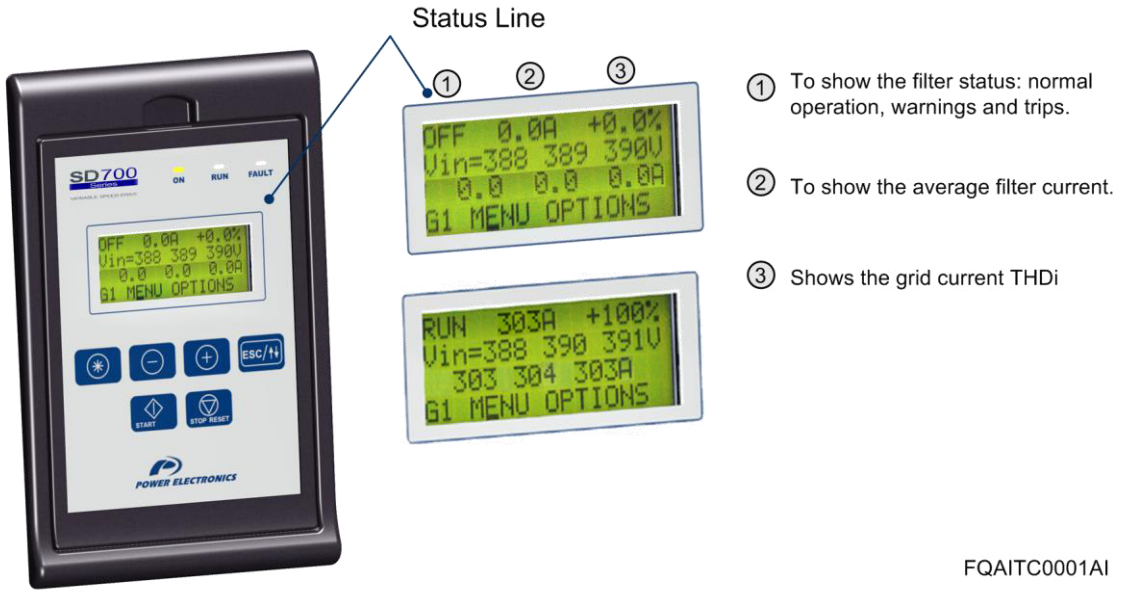


Figure 2.1 Status Line Description

Note: The user can access to the information displayed in status line via Modbus communication. See section 'Modbus Communication'.

2.1. List of Status Messages

Screen	Name	Description
OFF	Deactivated power	Drive power is deactivated.
RUN	Running	Drive is operating at reference speed. Operation at steady status.

2.2. List of Warning Messages

Screen	Name	Description
IPR	Current input protection	Input current has reached the 100% of the rated current.
IIB	Input current imbalance	Inverse input current has reached the 75% of the fault threshold “R19 I IM BIN”.
IGF	Input ground fault	Ground fault current has reached the 75% of the ground fault threshold.”R20 GRND INPUT.
TRB	Temperature rectifier bridge	The rectifier’s IGBTs have reached 90ºC.
FPS	Fan Power Supply	The rectifier’s fan power supply has a failure. The fault “R34 IGBT TEMP” will reduce its threshold value from 110ºC up to 90ºC, in order to protect the drive components.
PLL	Phase Locked Loop	The rectifier is synchronizing to the grid.
L2	Current Limitation 2º	The second harmonic current has reached the limit set in G4.3.
L4	Current Limitation 4º	The fourth harmonic current has reached the limit set in G4.4.
L5	Current Limitation 5º	The fifth harmonic current has reached the limit set in G4.5.
L7	Current Limitation 7º	The seventh harmonic current has reached the limit set in G4.6.
L11	Current Limitation 11º	The eleventh harmonic current has reached the limit set in G4.7.
L13	Current Limitation 13º	The thirteenth harmonic current has reached the limit set in G4.8.
CLT	Temporary Current Limitation	The temporary current has reached the maximum value set in G4.9.
LCL	Contactor LCL	The LCL feedback is not correctly.

3. PANTALLAS DE VISUALIZACIÓN Y ESTADOS. GRUPO G0

These parameters constantly indicate the input signal status and dynamic parameter status of the FQA. Visualization lines are the second and the third lines. The user can select the parameter to be displayed in each line from the different visualization options.

To select a display parameter you should move to the cursor to the second or third line. For this, you need to press **ESC / ↑ ↓** key for approx two seconds. The cursor moves from one line to the next. Once located on the second or third line you can navigate like the programming line (line 4) and select the desired parameter to be displayed. Once selected these parameters are saved into memory. These parameters are then displayed on lines 2 and 3 whenever the drive is powered up.
Thanks to these lines user can display desired parameters and obtain additional information easily.

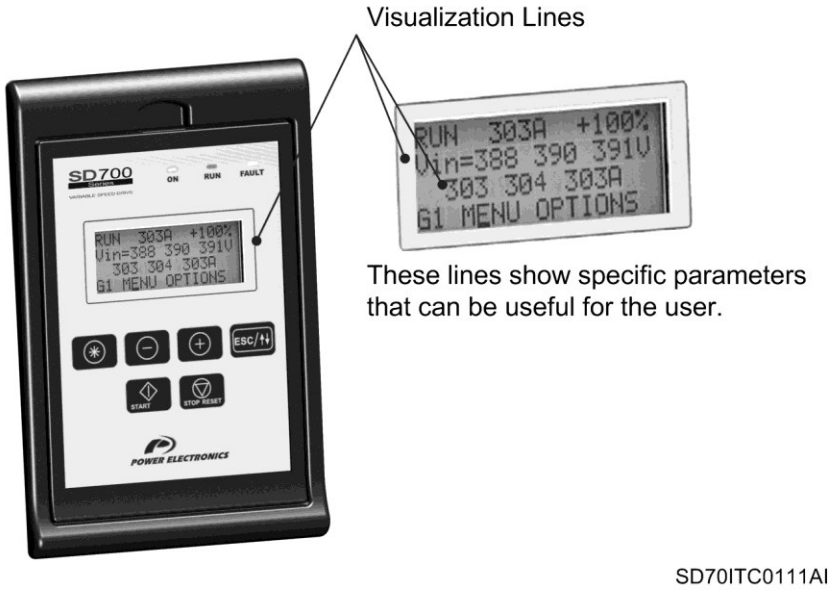


Figure 3.1 Visualization Lines Description

3.1. Parameters SV.1 – Load Visualisation

Screen	Units	Description
0.0A 0.0A 0.0A	A	It shows the instantaneous current of each phase of the load (U, V and W).
THDi Carg=30.0%	%	It shows the THDI load.

3.2. Parameters SV.2 – Visualisation of the equipment

Screen	Units	Description
0.0A 0.0A 0.0A	A	It shows the instantaneous current of each phase of the equipment (U, V and W).
Bus vol = 540V	VDC	It shows DC Link voltage of the equipment.
IGBT Temp =+23ºC	ºC	It shows the temperature measured at the power stage of the filter.
Frc PLL=50.0Hz	Hz	It shows the frequency of the PLL.
Modul level =95%	%	It shows the level of modulation.

3.3. Parameters SV.3 – Grid Visualisation

Screen	Units	Description
0.0V 0.0V 0.0V	V	It shows the instantaneous voltage composed of an input in each phase of the equipment (U, V and W).
Grid.Vol = 400V	V	It shows the grid voltage.
Grid.Frec =50Hz	Hz	It shows the grid frequency.
0.0A 0.0A 0.0A	A	It shows the grid current of each phase of the equipment (U, V and W).
Grid.THDi =3.0%	%	It shows the THDI grid.

3.4. Parameters SV.4 – Intern Visualization

Screen	Units	Description
Actual Fault = 00	-	It shows the present code fault. See fault history G13.
Filter.Curr = 170A	A	It shows the filter rated current (maximum current of the equipment at 50ºC).
Filter.Volt = 400V	V	It shows the filter rated voltage.
S/W	-	It shows the software version installed into the equipment.
H/W y.y	-	It shows the hardware version of the equipment.

4. DESCRIPTION OF PROGRAMMING PARAMETERS

The different parameters of the FQA are displayed in the alphanumeric LCD. These parameters are organized in groups (G1, G2, G3 …). To access to the parameters or sub-groups which are in a lower level, press the [*] key. When you have accessed the desired parameter, this parameter will be shown as either a numerical value or a list of possible options.

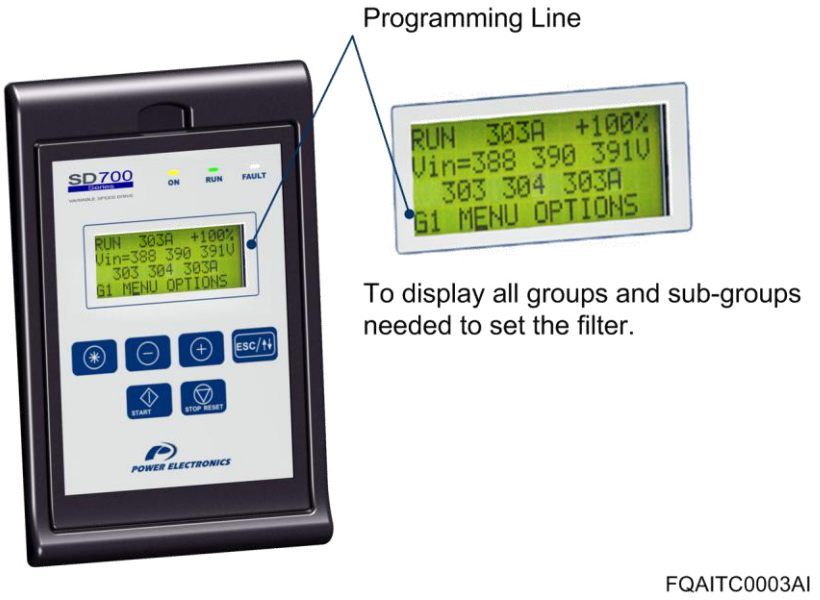


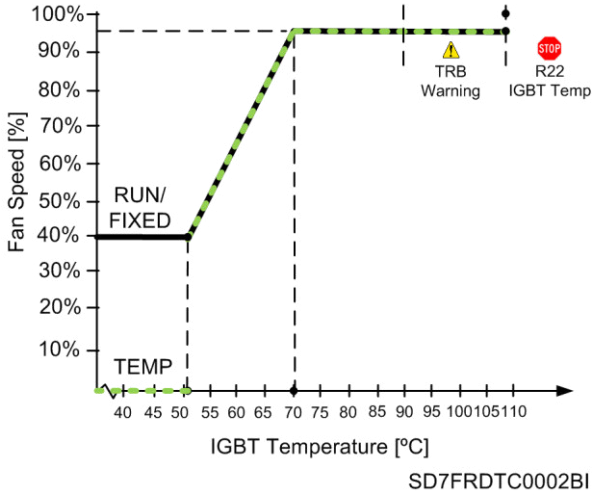
Figure 4.1 Detail of Programming Line.

See the information below for the whole parameter list and possible options of configuration.

4.1. Group 1 – G1: Options Menu

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 LANG=ESPANOL	**G1.1** / Language selection	ENGLISH ESPANOL	It allows selection of the user language.	NO
2 INITIALISE=0	**G1.2** / Parameter initialize	0 a 2	It allows selection of the parameters that we desire to initialize back to the factory default value.	YES

OPT.	DESCRIPTION	FUNCTION
0	NO	None of parameters is initialized.
1	USR PRMTR	User parameters are only initialized.
2	ALL PRMTR	All parameters of the drive are initialized.

<table>
<tr><th>Parameter / Default Value</th><th>Name / Description</th><th>Range</th><th>Function</th><th>Set on RUN</th></tr>
<tr><td>3 FAN CTRL=RUN</td><td>G1.3 / Drive fan control mode</td><td>RUN
TEMP
FIJO</td><td>It allows selecting the operation mode for drive fans. The FQA integrates a VSD system that varies the cooling flow depending on the IGBT temperature. All control modes respect the following speed vs. temperature curve.
<table>
<tr><th>OPTIÓN</th><th>FUNCTIÓN</th></tr>
<tr><td>RUN</td><td>Start command connect the fans at the minimum speed 40%. Then fan's speed will vary depending on the rectifier's IGBT temperature. The fans will stop 3 minutes after the rectifier bridge stopping.
Note: Rectifier bridge stops after the sum of the deceleration ramp time and the Delay IGBT off time.</td></tr>
<tr><td>TEMP</td><td>The fans' speed depends on the rectifiers IGBT temperature. The fans will be connected when the temperature is above 51ºC and stopped when the temperature is below 51ºC.</td></tr>
<tr><td>FIXED</td><td>Starts the fans following the speed curve even if the equipment is not running.</td></tr>
</table>

</td><td>YES</td></tr>
<tr><td>4 CNTROL MODE =LOCAL</td><td>G1.4 / Control Mode</td><td>LOCAL
REMOTE</td><td>It allows user to set the control mode for the equipment commands (Start/Stop, Reset ...).
<table>
<tr><th>OPTIÓN</th><th>FUNCTIÓN</th></tr>
<tr><td>LOCAL</td><td>Filter control is done by keypad.</td></tr>
<tr><td>REMOTO</td><td>Filter controlled through control terminals.</td></tr>
</table></td><td>NO</td></tr>
<tr><td>5 LCL=S</td><td>G1.5 / LCL Contactor</td><td>N
S</td><td>It allows user to activate or deactivate the LCL filter.
<table>
<tr><th>OPTIÓN</th><th>FUNCTIÓN</th></tr>
<tr><td>N</td><td>The filter is deactivated.</td></tr>
<tr><td>S</td><td>The filter is activated.</td></tr>
</table></td><td>YES</td></tr>
<tr><td>6 AUTOSTART=N</td><td>G1.6 / automatic start up.</td><td>N
S</td><td>It allows user to activate or deactivate the automatic start up.
<table>
<tr><th>OPTIÓN</th><th>FUNCTIÓN</th></tr>
<tr><td>N</td><td>Deactivated automatic start up.</td></tr>
<tr><td>S</td><td>Activated automatic start up.</td></tr>
</table></td><td>YES</td></tr>
</table>

4.2. Group 2 – G2: Active Filter Options

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 Type Ctrl =HARMONIC	**G2.1** / Control Type	TEMPORA-RY HARMÓNIC	This selection determines the type control of the filter. **OPT.** / **FUNCTIÓN** TEMPORARY – Harmonic deletion of the full spectrum. HARMÓNIC – Selective harmonic deletions.	YES
2 Loop-Type=CERR	**G2.2** / Loop Type	CERR ABRT	This selection determines the loop type of the filter. **OPT.** / **FUNCTIÓN** CLOSE – Current transformers are installed at the grid side. OPEN – Current transformers are installed at the load side.	YES
3 F Cut=4000Hz	**G2.3** / Cut Frequency	4000 to 6000Hz	IGBTs' switching frequency in harmonic control.	NO
4 Temp F=6000Hz	**G2.4** / Temporary control frequency l	6000 to 8000Hz	Temporary control frequency.	NO
5 Trf Ext=5/1000A	**G2.5** / Measure transformation relation.	5 to 5000A	It allows setting up the primary current of the current transformer. This value corresponds to the current value of the installation.	NO
6 Vbus Ref=600	**G2.6** / Bus Voltage reference	500Vdc to 825Vdc or 600Vdc to 1150Vdc	This parameter allows setting the bus DC voltage. A high voltage can cause higher loss of power and a high output value dV/dt. It is advised set it with the following equation: $Vdc_{REF}=Vin*\sqrt{2}*1.1$ The parameter range automatically varies according to the rated voltage of the equipment.	YES
7 Ctr React=NO	**G2.7** /Reactive monitoring method	NO FIXED	This selection determines the reactive current injection control method. **OPT.** / **FUNCTIÓN** NO – The filter does not inject reactive current. FIXED – The filter injects reactive current indicated in G2.8.	NO
8 Rea Rf=0	**G2.8** / Reative reference	0 to 1*In	Reactive current that is injected in the fixed method.	YES
9 Kp VDC=10.0	**G2.9** / PID Kp Vdc	0.0 to 100.0	It allows setting the proportional gain value PID of the closed loop control bus voltage.	YES
10 Ki VDC=3.5	**G2.10** / PID Ki Vdc	0.0 to 100.0	It allows setting the integral gain value PID of the closed loop control bus voltage.	YES

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4.3. Group 3 – G3: Harmonic Control

4.3.1. Subgroup 3.1 – S3.1: Fundamental PID

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 Kp PLL=10.0	**G3.1.1** / PID Kp PLL	0.0 to 100.0	It allows setting the proportional gain value PID of the PLL.	YES
2 Ki PLL=15.0	**G3.1.2** / PID Ki PLL	0.0 to 100.0	It allows setting the integral gain value PID of the PLL.	YES
3 Kp I=10.0	**G3.1.3** / PID Kp I	0.0 to 100.0	It allows setting the closed loop control proportional gain value of the current.	YES
4 Ki I=10.0	**G3.1.4** / PID Ki I	0.0 to 100.0	It allows setting the closed loop control integral gain value of the current.	YES

4.3.2. Subgroup 3.2 – S3.2: Harmonic 2

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 Harmn 2=INACTV	**G3.2.1** / control loopl 2º	INACTV ACTIVE	This selection determines if the control loop is active or not.	NO
2 Seq. 2=INVERSO	**G3.2.2** / Sequence 2º	DIRECT INVERSE	This selection determines if the control loop compensates the direct sequence or the inverse sequence.	NO
3 Kp Ar2=16.0	**G3.2.3** / PID Kp I 2º	0.0 to 100.0	It allows setting the proportional gain value PID of the control loop.	YES
4 Ki Ar2=5.0	**G3.2.4** / PID Ki I 2º	0.0 to 100.0	It allows setting the integral gain value PID of the control loop.	YES

4.3.3. Subgroup 3.3 – S3.3: Harmonic 4

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 Harmn 4=INACTV	**G3.3.1** / control loop 4º	INACTV ACTIVE	This selection determines if the control loop is active or not.	NO
2 Seq. 4=DIRECTO	**G3.3.2** / Sequence 4º	DIRECT INVERSE	This selection determines if the control loop compensates the direct sequence or the inverse sequence.	NO
3 Kp Ar4=16.0	**G3.3.3** / PID Kp I 4º	0.0 to 100.0	It allows setting the proportional gain value PID of the control loop.	YES
4 Ki Ar4=5.0	**G3.3.4** / PID Ki I 4º	0.0 to 100.0	It allows setting the integral gain value PID of the control loop.	YES

4.3.4. Subgroup 3.4 – S3.4: Harmonic 5

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 Harmn 5=ACTIVO	**G3.4.1** / control loop 5º	INACTV ACTIVE	This selection determines if the control loop is active or not.	NO
2 Seq. 5=INVERSO	**G3.4.2** / Sequence 5º	DIRECT INVERSE	This selection determines if the control loop compensates the direct sequence or the inverse sequence.	NO
3 Kp Ar5=16.0	**G3.4.3** / PID Kp I 5º	0.0 a 100.0	It allows setting the proportional gain value PID of the control loop.	YES
4 Ki Ar5=5.0	**G3.4.4** / PID Ki I 5º	0.0 a 100.0	It allows setting the integral gain value PID of the control loop.	YES

4.3.5. Subgroup 3.5 – S3.5: Harmonic 7

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 Harmn 7=ACTIVO	**G3.5.1** / control loop 7º	INACTV ACTIVE	This selection determines if the control loop is active or not.	NO
2 Seq. 7=DIRECTO	**G3.5.2** / Sequence 7º	DIRECT INVERSE	This selection determines if the control loop compensates the direct sequence or the inverse sequence.	NO
3 Kp Ar7=32.0	**G3.5.3** / PID Kp I 7º	0.0 to 100.0	It allows setting the proportional gain value PID of the control loop.	YES
4 Ki Ar7=5.0	**G3.5.4** / PID Ki I 7º	0.0 to 100.0	It allows setting the integral gain value PID of the control loop.	YES

4.3.6. Subgroup 3.6 – S3.6: Harmonic 11

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 Harmn 11=ACTIVO	**G3.6.1** / control loop 11º	INACTV ACTIVE	This selection determines if the control loop is active or not.	NO
2 Seq. 11=INVERSO	**G3.6.2** / Sequence 11º	DIRECT INVERSE	This selection determines if the control loop compensates the direct sequence or the inverse sequence.	NO
3 Kp Ar11=32.0	**G3.6.3** / PID Kp I 11º	0.0 to 100.0	It allows setting the proportional gain value PID of the control loop.	YES
4 Ki Ar11=5.0	**G3.6.4** / PID Ki I 11º	0.0 to 100.0	It allows setting the integral gain value PID of the control loop.	YES

4.3.7. Subgroup 3.7 – S3.7: Harmonic 13

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 Harmn 13=ACTIVO	**G3.7.1** / control loop 13º	INACTV ACTIVE	This selection determines if the control loop is active or not.	NO
2 Seq. 13=DIRECTO	**G3.7.2** / Sequence 13º	DIRECT INVERSE	This selection determines if the control loop compensates the direct sequence or the inverse sequence.	NO
3 Kp Ar13=32.0	**G3.7.3** / PID Kp I 13º	0.0 to 100.0	It allows setting the proportional gain value PID of the control loop.	YES
4 Ki Ar13=5.0	**G3.7.4** / PID Ki I 13º	0.0 to 100.0	It allows setting the integral gain value PID of the control loop.	YES

4.4. Group 4 – G4: Limits

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 I Max=1.0 In	**G4.1** /overload maximum current	0.25In to 1.0 In	It allows setting the overead fault level F21 I LIM ENT of the equipment.	YES
2 T I Limt=OFF	**G4.2** / Overload fault time	0 to 60, OFF	It allows timer and deactivate the fault F21 I LIM ENT.	YES
3 I2 Max=0.2 In	**G4.3** / current limit 2	0 to 2.0*In	It allows setting the current limit for the second harmonic control loop.	YES
4 I4 Max=0.2 In	**G4.4** / / current limit 4	0 to 2.0*In	It allows setting the current limit for the fourth harmonic control loop.	YES
5 I5 Max=0.7 In	**G4.5** / / current limit 5	0 to 2.0*In	It allows setting the current limit for the fifth harmonic control loop.	YES
6 I7 Max=0.3 In	**G4.6** / / current limit 7	0 to 2.0*In	It allows setting the current limit for the seventh harmonic control loop.	YES
7 I11 Max=0.2 In	**G4.7** / / current limit 11	0 to 2.0*In	It allows setting the current limit for the eleventh harmonic control loop.	YES
8 I13 Max=0.15 In	**G4.8** / Limite de corriente 13	0 to 2.0*In	It allows setting the current limit for the thirteenth harmonic control loop.	YES
9 ITem Max= In	**G4.9** / / current limit temporary control	0 to 2.0*In	It allows setting the current limit for the temporary control.	YES
10 R I max=0.5 In	**G4.10** / reactive current limit	0 to 1.0*In	It allows setting the reactive current limit.	YES

4.5. Group 5 – G5: Protections

<table>
<tr><th>Parameter / Default Value</th><th>Name / Description</th><th>Range</th><th>Function</th><th>Set on RUN</th></tr>
<tr><td>1 Fll Ground=10%</td><td>G5.1 / current detection from ground conductor</td><td>OFF, 0 to 30% In</td><td>It allows the filter generates automatically a fault F20 TIERRA ENT if an earth leakage current is above the value set in this parameter.</td><td>YES</td></tr>
<tr><td>2 Low V=360V</td><td>G5.2 / Low input voltage level</td><td>323 to 425V
586 to 621V</td><td rowspan="2">Input low voltage protection is a combination of parameters [G5.2] and [G5.3]. Drive turns off its output generating a fault F27 VIN LOW when average voltage, measured in the drive input, is below the value set in [G5.2] for the time set in [G5.3].
In case of the drive has a power supply of 690V, the default value in [G5.2] will be 600V and the range will be 586 – 621V.</td><td>YES</td></tr>
<tr><td>3 T Low V=5.0s</td><td>G5.3 / T Trip time because of low input voltage</td><td>0.0 to 60.0s, OFF</td><td>YES</td></tr>
<tr><td>4 HIGH VOLT=500V</td><td>G5.4 / / High input voltage level</td><td>418 to 587V
726 to 759V</td><td rowspan="2">Input high voltage protection is a combination of parameters [G5.4] and [G5.5]. El Drive turns off its output generating a fault F28 VIN HIGH when average voltage, measured in the drive input, is below the value set in [G5.4] for the time set in [G5.5].
In case of the drive has a power supply of 690V, the default value in 690V, the default value in [G5.4] will be 750V and the range will be 726 – 759V.</td><td>YES</td></tr>
<tr><td>5 HI V TO=5s</td><td>G5.5 / Trip time because of high input voltage</td><td>0.0 to 60.0s, OFF</td><td>YES</td></tr>
<tr><td>6 Rts Idsq=5.0s</td><td>G5.6 / Trip delay time due to output current imbalance</td><td>0.0 to 60.0s, OFF</td><td>It allows setting a delay time before tripping once current imbalance has been detected. Once this time is elapsed, the drive trips due to F19 DSQ I ENT.</td><td>YES</td></tr>
<tr><td>7 Dlasy VO = 5s</td><td>G5.7 / Trip delay time due to output voltage imbalance</td><td>0.0 to 60.0s, OFF</td><td>It allows setting a delay time before tripping once output voltage imbalance has been detected. Once this time is elapsed, the drive trips due to ‘F12 IMB V OUT’.</td><td>YES</td></tr>
<tr><td>8 LOW V BHV=1</td><td>G5.8 / Performance in case of input power loss</td><td>1 & 3</td><td>Modifies the drive response following an input power loss while motor is running according to next adjusts:
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th><th>FUNCTION</th></tr>
<tr><td>1</td><td>FAULTS</td><td>Drive will trip because of fault 'F11 VIN LOSS'.</td></tr>
<tr><td>3</td><td>DipVoltRecover</td><td>After a momentary power loss has occurred, an algorithm of controlled recovery is activated. Due to this, the motor speed is not affected significantly.
In case of loads with high inertia, the reduction of the speed will be minimal.</td></tr>
</table></td><td>YES</td></tr>
</table>

4.6. Group 6 – G6: Fault History

<table>
<tr><th>Parameter / Default Value</th><th>Name / Description</th><th>Range</th><th>Function</th><th>Set on RUN</th></tr>
<tr><td>1 F0 NO FAULT
LAST FAULT=FXX</td><td>G6.1 / Register 1 of fault history</td><td>-</td><td rowspan="6">The first parameter of this group allows visualizing the information about the last fault and additionally, it will be used as the first register of fault history.
The filter shows this screen in the case of a trip. Pressing [*] key approx two seconds provides access to the extended information that shows the order of fault: LAST FAULT=Fxx (when fault is reset). The equipment is reset by pressing the STOP-RESET key from display or by using an external reset (if connected). Several faults can be reset automatically using Auto Reset (See group G12).

A list of the last six faults in chronological order is shown. The most recent fault appears in first place (G13.1). Each time that a fault occurs, the drive shows the fault in parameter G13.1. After the fault is solved and reset, this fault will be shifted to the following position of fault register (G13.2). The previous faults will shift down one position. The oldest fault message (G13.6) will be lost.
Pressing [*] key approx two seconds provides access to the extended information that shows the order of fault:
FIFTH FAULT=Fxx up to FIRST FAULT=Fxx
The following table shows all the faults:

<table><tr><th>COD</th><th>FAULT</th><th>COD</th><th>FAULT</th></tr><tr><td>0</td><td>F0 NO FAULT</td><td>114</td><td>R14 VBUS LOST</td></tr><tr><td>101</td><td>R1 I LIM FLT</td><td>115</td><td>R15 SfCh CONTACT</td></tr><tr><td>102</td><td>R2 V LIM FLT</td><td>116</td><td>R16 LCL TEMP</td></tr><tr><td>103</td><td>R3 SOFT CHARG</td><td>117</td><td>R17 VBUS LOW</td></tr><tr><td>104</td><td>R4 OVERLOAD R+</td><td>118</td><td>R18 FIBR COMMS</td></tr><tr><td>105</td><td>R5 OVERLOAD R-</td><td>119</td><td>R19 I IMB IN</td></tr><tr><td>106</td><td>R6 OVERLOAD S+</td><td>120</td><td>R20 GRND INPUT</td></tr><tr><td>107</td><td>R7 OVERLOAD S-</td><td>121</td><td>R21 I LIMIT IN</td></tr><tr><td>108</td><td>R8 OVERLOAD T+</td><td>122</td><td>R22 IGBT TMP</td></tr><tr><td>109</td><td>R9 OVERLOAD T-</td><td>123</td><td>R23 I HALL</td></tr><tr><td>110</td><td>R10 MULTI O.L.</td><td>124</td><td>R24 LCL FB</td></tr><tr><td>111</td><td>R11 VIN LOST</td><td>127</td><td>F27 VIN LOW</td></tr><tr><td>112</td><td>R12 IMB V IN</td><td>128</td><td>F28 VIN HIGH</td></tr><tr><td>113</td><td>R13 V LOST CAP</td><td></td><td></td></tr></table></td><td>-</td></tr>
<tr><td>2 F0 NO FAULT
FIFTH FAULT=FXX</td><td>G6.2 / Register 2 of fault history</td><td>-</td><td>-</td></tr>
<tr><td>3 F0 NO FAULT
FOURTH FAULT=FXX</td><td>G6.3 / Register 3 of fault history</td><td>-</td><td>-</td></tr>
<tr><td>4 F0 NO FAULT
THIRD FAULT=FXX</td><td>G6.4 Register 4 of fault history</td><td>-</td><td>-</td></tr>
<tr><td>5 F0 NO FAULT
SECOND FAULT=FXX</td><td>G6.5 / Register 5 of fault history</td><td>-</td><td>-</td></tr>
<tr><td>6 F0 NO FAULT
FIRST FAULT=FXX</td><td>G6.6 / Register 6 of fault history</td><td>-</td><td>-</td></tr>
<tr><td>7 CLEAR FAULTS=N</td><td>G6.7 / Erase fault history</td><td>N
Y</td><td><table><tr><th>OPT.</th><th>FUNCTION</th></tr><tr><td>N=NO</td><td>Function disabled.</td></tr><tr><td>Y=YES</td><td>It erases fault history (last six faults). The screen returns to default value ‘NO’, after all the faults have been erased.</td></tr></table></td><td>YES</td></tr>
</table>

4.7. Group 7 – G7: Communication Buses

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 COMM ADDR =10	**G7.1** / Communication address	1 to 255	Sets the identification address assigned to the drive for communication via the Modbus network. If communication is required with several drives a different address is required for each unit.	YES
2 BAUDS=9600	**G7.2** / Communication speed	600 1200 2400 4800 9600 19200	Sets the data transmission speed for MODBUS serial communications. This rating should be the same as the rating of the master of the communication bus on which the drive is integrated.	YES
3 PARITY=NONE	**G7.3** / Communication parity	ODD NONE EVEN	MODBUS parity setting. Used for data validation. If you do not want to validate data, set this parameter to 'NONE'. Parity selection should be the same as the parity of the master of the communication bus on which the drive is integrated.	YES

4.8. Group 8 – G8: Autoreset

Parameter / Default Value	Name / Description	Range	Function	Set on RUN
1 AUTORESET=N	**G8.1** / Auto Reset	N Y	This function resets the drive automatically after a fault. **OPT.** / **FUNCTION** N=NO – Auto Reset is disabled. Y=YES – Auto Reset is enabled. When this function is active, faults programmed in G12.5 to G12.8 will be reset. ⚠ **Caution:** Auto Reset function can cause unexpected automatic starts. Ensure the installation is configured for Auto Reset to prevent damage to property or personnel.	YES
2 ATTEMP NUMBR=1	**G8.2** / Number of Auto Reset attempts	1 to 5	Allows setting of the maximum number of Auto Reset attempts. Drive will try to reset as many times as the number of attempts set in this screen after a fault occurs. This parameter and 'G12.4 RS COUNT' control the drive to carry out Auto Reset function in a controlled manner.	YES
3 R STR DEL =30s	**G8.3** / Delay time before Auto Reset	5 to 300s	Allows setting of the time elapsed from the fault occurring before attempting auto reset.	YES
4 T BORRAR=300s	**G8.4** / Reset time of the Auto Reset attempts meter	30 to 900s	Allows setting of the time that once elapsed will reset the Auto Reset attempt counter to zero. Two situations are possible: a) If the FQA is successfully restarted and runs for a period exceeding the value set in this screen then the attempt counter G12.2 will be reset to zero. b) If the total number of reset attempts is exceeded within this time period the FQA will fault on the last fault condition. The FQA will remain in a fault condition until the unit is manually reset.	YES

E S P A Ñ O L

5. MODBUS COMMUNICATION

5.1. Supported Modbus Function Codes

Serial communications protocol provided by FQA filter adheres to Modbus Industrial standard communications protocol of Modicon. The drive uses reading and writing functions between all of the functions that exist in Modbus protocol. The used functions by the drive are the following ones:

Function	Description	Registers Number
3	Registers Reading	120
16	Registers Writing	120

The implementation of this function code in the drive allows reading up to 120 registers into a Parameters Group in a frame. If you want to access to a consecutive memory registers, but belonging to different groups, you should access in so many frames as groups are involved.

5.1.1. Modbus Function Code Nº 3: Registers Reading

This function code allows the Modbus controller (master) to read the content of the data registers indicated in the drive (slave). This function code only admits uncast addressing. Broadcast or group cast addressing are not possible with this function code.

The implementation of this function code in the drive allows reading up to 120 registers with consecutive addresses of the drive in a single frame.

Next, a frame is shown where the master tries to read the content of 3 registers of a drive where the current used by each phase is. The information that should be attached in the ask frame is the following one:

- Data address of the drive.
- Modbus function code (3 Registers reading).
- Starting Data address.
- Registers number for reading.
- CRC-16 code.

The answer of the drive (slave) should contain the following fields:

- Data address of the slave.
- Modbus function code (3 Registers reading).
- Bytes number for reading.
- Bytes number / 2 registers.
- CRC-16 code.

Each register consists of 2 bytes (2x8bits=16 bits). This one is the default length of all of the registers that form the FQA.

5.1.1.1. Operation Example of Modbus Function Code Nº 3 (Registers Reading)

We suppose that we want to read the motor current (nameplate data) via communications. This data corresponds to the parameter G2.1 '1 MTR CUR=00.00A'. The frame that should be transmitted is:

Modbus Address	Modbus Function Code	Starting Data Address (40282)	Registers Number	CRC-16
0x0A	0x03	0x0119	0x0001	0x2493

We suppose that instantaneous current of the equipment is 8,2 A. (Modbus value 82 decimal = 0x52 Hexadecimal). The answer of the slave will be:

Modbus Address	Modbus Function Code	Bytes Number	Data (address 20) (=110)	CRC-16
0x0A	0x03	0x02	0x0052	0x9C78

5.1.2. Modbus Function Code Nº 16: Registers Writing

This function code allows the Modbus controller (master) to write the content of the data registers indicated in the drive (slave), whenever those registers are not of Read only. Registers writing by the master does not impede the later modification of those registers by the slave.
The implementation of this function code in the drive allows writing up to 5 registers of the drive in a single frame.

Next, a frame is shown where the master tries to write the content of 1 register that stores the acceleration time. The information that should be attached in the ask frame is the following one:

- Data address of the slave.
- Modbus function code (16 Registers writing).
- Starting Data Address.
- Registers number for writing.
- Bytes number for writing.
- Content of registers for writing.
- CRC-16 code.

The answer of the slaves includes:

- Data address of the slave.
- Modbus function code (16 Registers writing).
- Starting Data Address.
- Written registers number.
- CRC-16 code.

5.2. Addressing Modes

5.2.1. Broadcast Addressing Mode

Broadcast addressing mode allows the master to access at the same time to all of the slaves connected to the Modbus network. The Modbus function code that admits this global addressing mode is:

Function	Description
16	Registers Writing

In order to access to all of the equipments connected in a Modbus network, you must use the address 0.
When this address is used, all of the slaves in the Modbus network make the required task but they do not prepare any answer.

5.3. Remote Control Functions

HOST START CONTROL

Screen -
Range 0 – 1

Modbus address **40562**
Modbus range 0 to 1
Read / Write YES

Description It allows giving the start command to the equipment through communications network.

HOST STOP CONTROL

Screen -
Range 0 – 1

Modbus address **40563**
Modbus range 0 to 1
Read / Write YES

Description It allows giving the stop command to the equipment through communications network.

HOST RESET CONTROL

Screen -
Range 0 – 1

Modbus address **40564**
Modbus range 0 to 1
Read / Write YES

Description It allows giving the reset command to the equipment through communications network.

HOST TRIP CONTROL

Screen -
Range 0 – 1

Modbus address **40565**
Modbus range 0 to 1
Read / Write YES

Description It allows the equipment to generate a fault through communications network.

5.4. Summary of Modbus Addresses

5.4.1. Modbus Register 'GENERAL STATUS'

This register supplies information about the general status of the drive, as the following table shows:

Modbus Address	Bit	Description	Meaning on '0'	Meaning on '1'
40558	0	RUN	Drive stopped	Drive running

5.4.2. Programming Parameters

Parameter	Screen	Description	Address	Range	Modbus Range
G1.1	1 LANG=ESPANOL	Language selection	**40542**	ENGLISH ESPANOL	-
G1.2	2 INITIALISE=0	Parameter initialize	**40022**	0 to 2	-
G1.3	11 FAN CTRL=RUN	Unit fan control mode	**40023**	RUN TEMP FIXED	0 to 2
G1.4	4 Control Mode =LOCAL	Control mode	**40024**	LOCAL REMOTE	0 to 1
G1.5	5 LCL=S	LCL Contactor	**40025**	N Y	0 to 1
G1.6	6 AUTOSTART=N	Automatic start	**40026**	N Y	0 to 1
G2.1	1 Ctrl Type =HARMONIC	Control type	**40301**	TEMPORAL HARMÓNIC	0 to 1
G2.2	2 loop type=CERR	Loop type	**40302**	CLOSE OPEN	0 to 1
G2.3	3 F Cut=4000Hz	Cut frequency	**40303**	4000 to 6000Hz	4000 to 6000
G2.4	4 Temp F=6000Hz	Temporary control frequency	**40304**	6000 to 8000Hz	6000 to 8000
G2.5	5 Trf Ext=5/1000A	Measure transformation relation	**40305**	5 to 5000A	5 to 5000
G2.6	6 Vbus Ref=600	Bus voltage reference	**40306**	500Vdc to 825Vdc or 600Vdc to 1150Vdc	500 to 825 or 600 to 1150
G2.7	7 React Ctr =NO	Reactive control method	**40307**	NO FIXED	0 to 1
G2.8	8 Rea Rf=0	Reactive reference	**40308**	0 to 1*In	0 to 8192
G2.9	9 Kp VDC=10.0	PID Kp Vdc	**40309**	0.0 to 100.0	0 to 1000
G2.10	10 Ki VDC=3.5	PID Ki Vdc	**40310**	0.0 to 100.0	0 to 1000
G3.1.1	1 Kp PLL=10.0	PID Kp PLL	**40601**	0.0 to 100.0	0 to 1000
G3.1.2	2 Ki PLL=15.0	PID Ki PLL	**40602**	0.0 to 100.0	0 to 1000
G3.1.3	3 Kp I=10.0	PID Kp I	**40603**	0.0 to 100.0	0 to 1000
G3.1.4	4 Ki I=10.0	PID Ki I	**40604**	0.0 to 100.0	0 to 1000
G3.2.1	1 Harmn 2=INACTV	Control loop 2	**40641**	INACTV ACTIVE	0 to 1
G3.2.2	2 Seq. 2=INVERSE	Sequence 2º	**40642**	DIRECT INVERSE	0 to 1
G3.2.3	3 Kp Ar2=16.0	PID Kp I 2º	**40643**	0.0 to 100.0	0 to 1000
G3.2.4	4 Ki Ar2=5.0	PID Ki I 2º	**40644**	0.0 to 100.0	0 to 1000
G3.3.1	1 Harmn 4=INACTV	Control loop 4	**40681**	INACTV ACTIVE	0 to 1
G3.3.2	2 Seq. 4=DIRECT	Sequence 4º	**40682**	DIRECT INVERSE	0 to 1
G3.3.3	3 Kp Ar4=16.0	PID Kp I 4º	**40683**	0.0 to 100.0	0 to 1000
G3.3.4	4 Ki Ar4=5.0	PID Ki I 4º	**40684**	0.0 to 100.0	0 to 1000
G3.4.1	1 Harmn 5=ACTIVE	Control loop 5	**40721**	INACTV ACTIVE	0 to 1
G3.4.2	2 Sec. 5=INVERSO	Sequence 5º	**40722**	DIRECTO INVERSO	0 to 1
G3.4.3	3 Kp Ar5=16.0	PID Kp I 5º	**40723**	0.0 to 100.0	0 to 1000
G3.4.4	4 Ki Ar5=5.0	PID Ki I 5º	**40724**	0.0 to 100.0	0 to 1000
G3.5.1	1 Harmn 7=ACTIVE	Control loop 7	**40761**	INACTV ACTIVE	0 to 1
G3.5.2	2 Seq. 7=DIRECTE	Sequence 7º	**40762**	DIRECTE INVERSE	0 to 1
G3.5.3	3 Kp Ar7=32.0	PID Kp I 7º	**40763**	0.0 to 100.0	0 to 1000
G3.5.4	4 Ki Ar7=5.0	PID Ki I 7º	**40764**	0.0 to 100.0	0 to 1000
G3.6.1	1 Harmn 11=ACTIVE	Control loop 11º	**40801**	INACTV ACTIVE	0 to 1
G3.6.2	2 Seq. 11=INVERSE	Sequence 11º	**40802**	DIRECTE INVERSE	0 to 1
G3.6.3	3 Kp Ar11=32.0	PID Kp I 11º	**40803**	0.0 a 100.0	0 to 1000
G3.6.4	4 Ki Ar11=5.0	PID Ki I 11º	**40804**	0.0 a 100.0	0 to 1000
G3.7.1	1 Harmn 13=ACTIVE	Control loop 13º	**40841**	INACTV ACTIVE	0 to 1
G3.7.2	2 Seq. 13=DIRECTE	Sequence 13º	**40842**	DIRECTE INVERSE	0 to 1
G3.7.3	3 Kp Ar13=32.0	PID Kp I 13º	**40843**	0.0 to 100.0	0 to 1000
G3.7.4	4 Ki Ar13=5.0	PID Ki I 13º	**40844**	0.0 to 100.0	0 to 1000

Parameter	Screen	Description	Address	Range	Modbus Range
G4.1	1 I Max=1.0 In	Overload maximum current	**40901**	0.25In to 1.0 In	2048 to 16384
G4.2	2 T I Limt=OFF	Overhead fault time	**40902**	0 to 60, OFF	0 to 601
G4.3	3 I2 Max=0.2 In	Current limit 2	**40903**	0 to 2.0*In	0 to 16384
G4.4	4 I4 Max=0.2 In	Current limit 4º	**40904**	0 to 2.0*In	0 to 16384
G4.5	5 I5 Max=0.7 In	Current limit 5º	**40905**	0 to 2.0*In	0 to 16384
G4.6	6 I7 Max=0.3 In	Current limit 7º	**40906**	0 to 2.0*In	0 to 16384
G4.7	7 I1 Max=0.2 In	Current limit 11º	**40907**	0 to 2.0*In	0 to 16384
G4.8	8 I3 Max=0.15 In	Current limit 13º	**40908**	0 to 2.0*In	0 to 16384
G4.9	9 ITem Max= In	Temporary control current limit	**40909**	0 to 2.0*In	0 to 16384
G4.10	10 R I max=0.5 In	Reactive current limit	**40910**	0 to 1.0*In	0 to 8192
G5.1	1 FII Ground=10%	Current detection from ground conductor	**41201**	OFF, 0 to 30% In	0 to 2458
G5.2	2 Low V=360V	low voltage input level	**41202**	323 to 425V 586 to 621V	400V ➔ 3230 to 4250 690V ➔ 5860 to 6210
G5.3	3 Low V T =5.0s	Trip time because of low input voltage.	**41203**	0.0 to 60.0s, OFF	0 to 600; 610
G5.4	4 High Volt =500V	High voltage input level	**41204**	418 to 587V 726 to 759V	400V ➔ 4180 to 5870 690V ➔ 7260 to 7590
G5.5	5 Hi V To =5.0s	Trip time because of high input voltage	**41205**	0.0 to 60.0s, OFF	0 to 600; 610
G5.6	6 Dlasy VO =5.0s	Delay time due to output voltage imbalance	**41206**	0.0 to 60.0s, OFF	0 to 600, 601
G5.7	7 Rts Vdsq=5.0s	Delay time due to output voltage imbalance	**41207**	0.0 to 60.0s, OFF	0 to 600, 601
G5.8	8 Low v bhv =1	Performance in case of input power loss	**41208**	1 and 3	1 and 3
G6.1	1 Last fault =fxx	Register 1 of fault history	**40432**	-	-
G6.2	2 Fifth fault =FXX	Register 2 of fault history	**40433**	-	-
G6.3	3Fourth FL=FXX	Register 3 of fault history	**40434**	-	-
G6.4	4 Third FL=FXX	Register 4 of fault history	**40435**	-	-
G6.5	5 Second FL=FXX	Register 5 of fault history	**40436**	-	-
G6.6	6 First FL=FXX	Register 6 of fault history	**40437**	-	-
G6.7	7 Clear faults =N	Erase fault history	**40438**	N S	0 to 1
G7.1	1 Modbus Dir =10	Communication direction	**41501**	1 to 255	1 to 255
G7.2	2 Baudrat=9600	Communication speed	**41502**	600 1200 2400 4800 9600 19200 38400	0 to 6
G7.3	3 Parity=NINGUN	Communication parity	**41503**	ODD NONE EVEN	0 to 2
G8.1	1 AUTORESET=N	Auto Reset	**41601**	N S	0 to 1
G8.2	2 ATTEMP NUMBR =1	Number of Auto Reset attempts	**41602**	1 to 5	1 to 5
G8.3	3 R STR DEL =30s	Delay time before Auto Reset	**41603**	5 to 300s	5 to 300
G8.4	4 RS COUNT =300s	Reset time for the counter of Auto Reset attempts	**41604**	30 to 900s	30 to 900

5.4.3. Visualization Parameters

Parameter	Screen	Description	Address	Modbus Range
STATUS LINE	**OFF** 0.0A +0.0%	Present status of the drive.	**40219**	0 a 201

Modbus value for warning and fault status.

Modbus value ➔ STATUS MESSAGE			
0 ➔ OFF	3 ➔ RUN		

Modbus value ➔ WARNING MESSAGES		
61 ➔ MOL	67 ➔ VLT	80 ➔ CCM
62 ➔ CL4	75 ➔ IPR	81 ➔ FPS
63 ➔ MOC	76 ➔ IIB	82 ➔ PLL
64 ➔ DOC	77 ➔ IGF	83 ➔ SWM
65 ➔ ILT	78 ➔ RTC_COMM_LOST	84 ➔ LCL
66 ➔ TLT	79 ➔ TRB	

Modbus value➔ FAULT MESSAGES			
120 ➔ NFL	228 ➔ F08	236 ➔ F16	247 ➔ F27
221 ➔ F01	229 ➔ F09	237 ➔ F17	248 ➔ F28
222 ➔ F02	230 ➔ F10	239 ➔ F19	149 ➔ F29
223 ➔ F03	231 ➔ F11	240 ➔ F20	164 ➔ F44
224 ➔ F04	232 ➔ F12	241 ➔ F21	172 ➔ F52
225 ➔ F05	233 ➔ F13	242 ➔ F22	157 ➔ F37
226 ➔ F06	234 ➔ F14	243 ➔ F23	174 ➔ F54
227 ➔ F07	235 ➔ F15	244 ➔ F24	

STATUS LINE	OFF **0.0A** +0.0%	Filter output current.	**40163**	Real value = (Modbus value / 10)
STATUS LINE	OFF 0.0A **+0.0%**	Grid THDI.	**40170**	8192 = 100% of motor rated speed

Note for drive status

Equipment status.
Parameter Equipment Status has Word size like the rest of Modbus parameters.
The information of the previous tables about status messages, warning and fault messages will be displayed by means of the Low Byte (LSB).
The High Byte (MSB) is reserved for internal use (bit by bit). Interesting information for the user is below:

- Bit 15:
  0 ➔ Drive with no fault.
  1 ➔ Drive in fault status.
- Bit 12:
  0 ➔ Drive started.
  1 ➔ Drive stopped.

Alternation between two states.
During the standard running of the equipment, the drive status value will appear in a stable and continuous way, only changing when the drive status changes (from 'ACL' (Accelerating) to 'RUN', for example). Nevertheless, there are two situations where the status value intermittently alternates between two states:

- First case: If the equipment presents a warning, this one will appear by alternating with the equipment status, for example, normal status 'RUN' and the warning 'ILT' will be alternatively and intermittently displayed.
- Second case: If a fault occurs, the last status value before the fault has occurs will be shown in alternation with the present fault number. For example, normal status 'RUN' and 'F40' will be alternatively and intermittently displayed.

Parameter	Screen	Description	Address	Modbus Range
SV1.1	0.0A 0.0A 0.0A	Load current (U,V,W).	**42001 → U** **42002 → V** **42003 → W**	Real value = (Modbus value / 10)
SV1.5	Load THDi =	Load THDi	**42004**	8192 = 100% maximum range
SV2.1	0.0A 0.0A 0.0A	Unit current (U,V,W).	**42101 → U** **42102 → V** **42103 → W**	Real value = (Modbus value / 10)
SV2.2	Bus Vol =	Bus voltage	**42104**	Real value = Modbus value
SV2.3	IGBT=Tempr	IGBT's temperature	**42105**	Real value = Modbus value
SV2.4	Frc PLL=	PLL Frequency	**42106**	Real value = (Modbus value / 10)
SV2.5	Modul level =	Modulation level	**42107**	8192 = 100% maximum range
SV3.1	390 390 390V	Input instantaneous voltage (RS,ST,RT)	**42201 → RS** **42202 → ST** **42203 → RT**	Real value = Modbus value
SV3.2	Grid Vol =	Grid voltage	**42204**	Real value = Modbus value
SV3.3	Grid Freq =	Grid frequency	**42205**	Real value = (Modbus value / 10)
SV3.4	0.0A 0.0A 0.0A	Grid current (U,V,W).	**42206 → U** **42207 → V** **42208 → W**	Real value = (Modbus value / 10)
SV3.5	Grid THDi=	Grid THDi	**42209**	8192 = 100% maximum range
SV4.1	Actual Fault = 00	Actual fault code.	**40235**	Fault number
SV4.2	Rated Curr = 170A	Filter rated current.	**40209**	Real value = (Modbus value / 10)
SV4.3	Rated V = 400V	Filter rated voltage.	**40210**	Real value = (Modbus value / 10)
SV4.4	S/W	Unit software version.	**40206**	Real value = Modbus value
SV4.5	H/W y.y	Unit hardware version.	**40207**	V Real value = (Modbus value / 100)

6. FAULT MESSAGES. DESCRIPTIONS AND ACTIONS

When a fault occurs the FQA will stop the motor and show the generated fault on the display. You can display this fault in the programming line (lower line) while motor current and the speed values at the moment of the fault are displayed in the upper line.
It is possible to navigate through the additional display lines to access other status parameters without resetting the fault. These additional status parameters offer further information about the moment at which the fault occurred. Additionally, the FAULT led will blink and the fault message will be displayed until the fault is remedied and the drive is reset.

Figure 6.1 Fault displaying - Programming Line

6.1. Description of Fault List

DISPLAY	DESCRIPCIÓN
F0 NO FAULT	Drive is operative. There is no fault.
F1 I LIM FLT	Output current has reached a dangerous level. Its value is above 220% of the drive rated current. Protection is activated instantaneously.
F2 V LIM FLT	DC Bus voltage has reached a dangerous level >850VDC (Vn=400Vac) and >1250Vdc (Vn=690Vac). Hardware Protection. Drive will turn off the output to the motor.
F3 PDINT FLT	DC Bus voltage and the output current of the equipment have reached dangerous levels.
F4 OVERLOAD U+	Internal protection within the appropriate IGBT semiconductor has acted.
F5 OVERLOAD U-	
F6 OVERLOAD V+	
F7 OVERLOAD V-	
F8 OVERLOAD W+	
F9 OVERLOAD W-	
R10 MULTI O.L.	
R11 VIN LOST	Voltage input measure is lost.
R12 IMB V IN	Inverse Input voltage is greater than +30% of average input voltage for a time higher than 100ms.
R13 V LOST CAP	Capacitor voltage measure is lost.
R14 VBUS LOST	DC bus voltage measure is lost.
R15 SfCh CONTACT	The feedback contactor signal is lost. The soft charge contactor is faulty or the activation signal is lost. The soft change contactor was connected when the order has been given. Take a look to the wiring (no resettable).
R16 LCL TEMP	The LCL filter has reached a dangerous temperature level.
R17 VBUS LOW	Low bus voltage detected <450VDC (Vn=400Vac) and <800Vdc (Vn=690Vac)
R19 I IMB IN	Inverse input current has reached (G22.11.7x In) limit for a time higher than 10ms.
R20 GRND INPUT	Ground fault input current has reached (G22.11.8x In) limit.
R21 I LIMIT IN	Input current has exceeded the current limit set in 'G22.11.5' for the time set in 'G22.11.6.
R22 IGBT TMP	Rectifier bridge IGBTs temperature has reached 110ºC (See SV7.4)
R23 I HALL	Rectifier Current Hall Sensor Connection.
F27 LOW INV	Low input voltage.
F28 HIGH INV	High input voltage.

E S P A Ñ O L

6.1.1. List and Solutions of Rectifier bridge faults

DISPLAY	POSSIBLE CAUSE	ACTIONS
R1 I LIM FLT	The input current measure signal has been lost.	Check the current sensors are correctly fastened.
	The input voltage measure signal has been lost.	Check the voltage sensors are correctly fastened.
	Incorrect setting of the current control loop.	Readjust the parameters G22.10.5 and G22.10.6.
	A voltage dip has occurred.	Try to reset the fault. If the fault persists contact Power Electronics for technical service.
R2 V LIM FLT	Deceleration ramp too high (parameters 'G5.2 DECEL1' and 'G5.4 DECEL2') or rectifier's "PID Vdc" parameters are too slow.	Decrease deceleration ramps. If the fault persists contact Power Electronics for technical service.
R3 SOFT CHARG	Soft charge contactor or resistors failure.	Try to reset the fault. Disconnect and re-connect again the input power. If the fault persists contact Power Electronics for technical service.
R4 OVERLOAD R+ R5 OVERLOAD R- R6 OVERLOAD S+ R7 OVERLOAD S- R8 OVERLOAD T+ R9 OVERLOAD T- R10 MULTI O.L.	Rectifier bridge IGBTs desaturation. See possible causes for faults F4-F9.	Check if there is possible input wiring faults. If the fault persists after disconnecting input wires request technical assistance.
R11 VIN LOST	Input power phase lost.	Check the input wiring is correctly installed.
	Input voltage measure has been lost.	Check the voltage sensors are correctly fastened.
R12 IMB V IN	Imbalance voltage input.	Possible internal wiring disconnection. Check the input wiring is correctly installed and the status of the input power supply is correct.
R13 V LOST CAP	Voltage lost in the capacitor of the LCL filter.	Possible internal wiring disconnection. Disconnect and re-connect again the input power. If the fault persists contact Power Electronics for technical service.
R14 VBUS LOST	DC bus voltage signal is lost.	
R15 SfCh CONTACT	Feedback signal from the soft charge contactor is lost. Feedback is wrong wired.	Check that voltage signal connector is correctly fastened. If the fault persists contact Power Electronics for technical service. When the fault is produced when the VFD is power supplied, stop, check the contactor and start.
R16 LCL TEMP	The fans of the LCL filter zone are faulty.	Check that the fans rotate smoothly and there isn't any obstacle.
R17 VBUS LOW	Low bus voltage detected.	Input voltage is lost and the electronics power supply keep powered
R19 I IMB IN	Unstable grid.	Check the parameter "G22.11.7 I Imb" value. If the fault persists contact Power Electronics technical service.
	Wiring fault.	
R20 GRND INPUT	Wiring fault.	Check power wiring about visual damages.
R21 I LIMIT IN	Input short-circuit.	Check the parameter "G22.11.5 I lima REC" value and the load.
	Wiring fault.	
	Circuit fault.	
R22 IGBT TMP	See possible causes for F34 fault.	See possible solutions described for F34 fault.
R23 I HALL	Incorrect Rectifier Current Hall Sensor Connection.	Check the Current Hall Sensor wires.
F27 LOW INV	Wrong input voltage, damaged fuses.	Check the input voltage.
	Parameter G5.2 is incorrectly settled.	Check the parameter G5.2 value.
F28 HIGH IN V	Wrong input voltage.	Check the input voltage.
	Parameter G5.4 is incorrectly settled.	Check the parameter G5.4 value.

7. CONFIGURATION REGISTER

ACTIVE FILTER: FQA.
SERIAL Nº: MODEL:
APPLICATION:
DATE:
CUSTOMER:
NOTES:

PARAMETERS	FACTORY SETTINGS	SETTING 1	SETTING 2
G1: Options Menu			
4 LANG=ESPANOL	ESPANOL	_____	_____
5 INITIALISE =0	0	_____	_____
11 FAN=FIXED	FIXED	_____	_____
4 CONTROL MODE =LOCAL	LOCAL		
5 LCL=S	Y		
6 AUTOSTART=N	N		
G2: Active Filter Options			
1 CTRL TYPE =HARMONIC	HARMONIC	_____	_____
2 LOOP TYPE=CLOSED	CLOSED	_____	_____
3 F CUT=4000Hz	4000Hz	_____	_____
4 F TEMP =6000Hz	6000Hz	_____	_____
5 EXT TRF =5/1000A	1000A	_____	_____

PARAMETERS	FACTORY SETTINGS	SETTING 1	SETTING 2
6 REF VBUS =600V	600V		
7 REACT CTR =NO	NO		
8 RF REA =0	0		
9 VDC KP =10.0	10.0		
10 VDC KI =3.5	3.5		
G.3: Harmonic Control – S3.1: Fundamental PID			
1 PLL KP =10.0	10.0		
2 PLL KI =15.0	15.0		
3 KP I=10.0	10.0		
4 KI I=10.0	10.0		
G.3: Harmonic Control – S3.2: Harmonic 2			
1 HARMN 2=INACTV	INACTV		
2 SEQ. 2=INVERSE	INVERSE		
3 KP HAR2=16.0	16.0		
4 KI HAR2=5.0	5.0		
G.3: Harmonic Control – S3.3: Harmonic 4			
1 HARMN 4=INACTV	INACTV		
2 SEQ. 4=DIRECT	DIRECT		
3 KP HAR4=16.0	16.0		
4 KI HAR4=5.0	5.0		
G.3: Harmonic Control – S3.4: Harmonic 5			
1 HARMN 5=ACTIVE	ACTIVE		
2 SEQ. 5=INVERSE	INVERSE		
3 KP HAR5=16.0	16.0		
4 KI HAR5=5.0	5.0		
G.3: Harmonic Control – S3.5: Harmonic 7			
1 HARMN 7=ACTIVE	ACTIVE		
2 SEQ. 7=DIRECT	DIRECT		
3 KP HAR7=32.0	32.0		
4 KI HAR7=5.0	5.0		
G.3: Harmonic Control – S3.6: Harmonic 11			
1 HARMN 11=ACTIVE	ACTIVE		
2 SEQ. 11=INVERSE	INVERSE		
3 KP HAR11=32.0	32.0		
4 KI HAR11=5.0	5.0		

PARAMETERS	FACTORY SETTINGS	SETTING 1	SETTING 2
G.3: Harmonic Control – S3.7: Harmonic 13			
1 HARMN 7=ACTIVE	ACTIVE		
2 SEQ. 7=DIRECT	DIRECT		
3 KP HAR7=32.0	32.0		
4 KI HAR7=5.0	5.0		
G4: Limits			
1 I MAX=1.0In	1.0In		
2 T I Limt=OFF	OFF		
3 I2 MAX=0.2In	0.2In		
4 I4 MAX=0.2In	0.2In		
5 I5 MAX=0.7In	0.7In		
6 I7 MAX=0.3In	0.3In		
7 I11 MAX=0.2In	0.2In		
8 I13 MAX=0.15In	0.15In		
9 ITEM MAX=In	In		
10 R I MAX=0.5In	0.5In		
G5: Protections			
1 Fll Ground=10%	10%		
2 low V=360V	360V		
3 Low T V=5.0s	5.0s		
4 High V=500V	500V		
5 High T V=5.0s	5.0s		
6 Rts Idsq=5.0s	5.0s		
7 Rts Vdsq=5.0s	5.0s		
8 Leak Comp VE=1	1		
1 Fll Ground=10%	10%		
G6: Faults History			
1 F0 NO FAULT LAST FAULT=FXX	-		
2 F0 NO FAULT FIFTH FAULT=FXX	-		
3 F0 NO FAULT FOURTH FAULT=FXX	-		
4 F0 SIN FALLOS TERCER FLL=FXX	-		
5 F0 NO FAULT SECOND FAULT=FXX	-		
6 F0 NO FAULT FIRST FAULT=FXX	-		
7 CLEAR FAULTS=N	N		

PARAMETERS	FACTORY SETTINGS	SETTING 1	SETTING 2
G7: Communication Buses			
1 MODBUS ADDRESS =10	10	_____	_____
2 BAUDS=9600	9600	_____	_____
3 PARITY=NONE	NONE	_____	_____
G8: Auto-reset			
1 AUTO RESET=N	N	_____	_____
2 ATTEMP NUMBR=1	1	_____	_____
3 R STR DEL =30s	30s	_____	_____
4 RS COUNT=300s	300s	_____	_____

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