ESV
ELECTRONIC SPEED VARIATOR

New Intelligent Systems

User's Manual
(quick start)

STM
RIDUTTORI

1. GENERAL INFORMATION

1.1 Manufacturer and machine data

Manufacturer: S.T.M. Spa - Via del Maccabreccia, 39
                    I 40012 Lippo di Calderara di Reno – (BO)
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Model and serial number : model, serial number and main characteristics of the device are placed on the product identification plate, on the top of the cover of the control box (fig. 1.3). In fig. 1.1 it is showed the place of the electric motor, while in fig. 1.2 it is showed a representation of the plate itself and   the different descriptive fields .

1.   motor frame
2.   control box
3.   enclosure cover of control box
4.   fairlead for the entry of the supply cable
5.   cooling fan and relative protection
6.   drive shaft
7.   fixing flange of the device
8.   ESV identification plate
9.   display
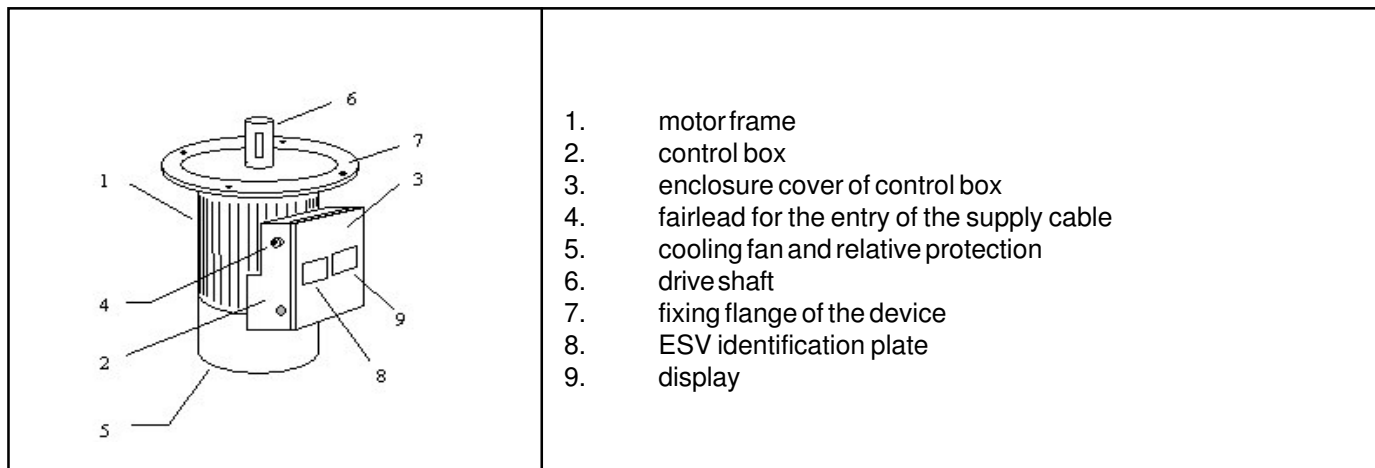
Fig. 1.1

Fig. 1.2

STM					
BOLOGNA-ITALY CE					
Tipo		Nr.			
Prot.IP		Serv.	Cos.φ		Is. Cl.
V Δ/Y	Hz.	HP	KW	min-1	A Δ/Y
Motore asincrono-Asyncronous motor					

Fig. 1.3
ESV
identification
plate

E S V
ELECTRONIC SPEED VARIATOR

BOLOGNA-ITALY
T +39/051/64.67.711
www.stmspa.com

TIPO   **ESV O5 4TS 71B4 B5**   CODICE   **2502710081**
TYPE   CODE
ALIMENTAZIONE **400V 50/60 HZ**   DATA **06/00**   NUMERO **376.2000.A**
SUPPLY   DATE   NUMBER

1.2 Guarantee and service conditions

The guarantee conditions and modalities to refer to are the ones indicated on the backside of the transport document.
If authorised service is required please ask the supplier.

1.3 Used symbology

Hereafter follows the list of the conventional symbols used in the present manual with relative explanation.

SYMBOL	DESCRIPTION
	GENERAL DANGER It signals to the personnel that the described operations **could cause accident** , if not made in the respect of the indicated safety norms.
	ELECTROCUTION DANGER It signals the interested personnel that the described operation could cause electric shock or other electric damages if not made in the respect of the indicated safety norms.
	FIRE DANGER It signals the interested personnel that the described operation or circumstance could cause fires.
	PERSONAL PROTECTION This symbol requires the use of personal protections to the operator while making the described operations.
	N.B. It signals to the interested personnel important information about the management of the machine.

1.4 Safety global aspects

☞ This manual contains important information to avoid that incorrect use of ESV causes danger to people or things. Carefully follow the instructions during the installation and use phase of the device.

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Before installing ESV check to have received the right model by carefully reading the information on the device plate; see description at point 1.1. If a wrong model was delivered, immediately contact the supplier.
The ESV presented in this manual is an electric motor with a variable speed, to be used on a machinery and supplied by electric line.
The above machineries could be dangerous for the users/operators, both as for the electric supply and for the handling of electrical organs. Consequently, before starting the machinery described in this manual (hereinafter called «ESV») it is compulsory to carefully follow instructions in this manual.
ESV installation and use must be made by qualified personnel for mechanical and electrical operations on the machinery.
Immediately inform the supplier of eventual damages during the transport: in this case do not start it.
Keep these instructions in a safe place and easy to consult.

All adjustment operations of internal parameters which provide for the access to the control box must be made with no supply of electric energy and after having waited at least five minutes from all phases disconnection before removing the cover from the control box.

- No modification of any kind must be made to the machinery
- The components of the machinery (motor, control box, electronic cards, etc.) mustn't be disassembled
- Do not put any kind of object inside the control box
- Inside the system there are no repairable or upkeepable parts from the user. In case of breakdown switch the machine of the supply and contact the authorised service

1.5 Responsibilities

S.T.M. Spa undertakes no responsibility for consequences and damages caused by the non respect of what expressed in the present manual.
It is user's competence and responsibility to determinate the risks and find out the adequate safety norms of the system on which ESV is installed .

This technical documentation (MUM - ESV/SRID -rev. 2 dated 20th of April 2004 - extract from NORM 0141) cancels and substitutes each previous edition and revision. We reserve the right to modify the above mentioned documentation everytime it will be necessary.
If you do not receive this document by means of a controlled distribution, its updating won't be assured. In order to verify whether this is the last version, do not hexitate to contact STM Sales Dept.

2. MACHINE DESCRIPTION AND TECHNICAL DATA

2.1 General description product

The electronic speed variator is given by an electric motor which is controlled by an electronic circuit.
The control keyboard allows the user to easily and quickly enter any parameter necessary for the required working conditions.
The threephase, variable frequency, alternate voltage, controlled by microprocessor, is delivered to the motor through a power module which uses the most recent IGBT technology.
The use of microprocessor, IGBT technology and modulation frequency programming, assures an extremely accurate and silent operation.
The software, properly developed for power electronics, allows for an accurate and quick control of motor speed, start and stop times which can be independently adjusted, and other operation conditions:

· Speed control as a function of the load is by current adjustment, thus allowing for automatic adjustment to process.
· Automatic boost that allows for a safe start of the motor by acting on the torque as a function of the load. Presence of high torques and rotation evenness at very low frequencies too.
· Direct current braking, with programmable duration and value, allowing for a comfortable motor stop.
· Presence of a standard serial line (SBI Serial Bus Interface), for Fields Bus with hardware protocol RS485 , CAN BUS, PROFIBUS. Programmable transmission modes, to remote program and/or control the converter.

Here below are listed ESV main characteristic in a normal continuous functioning cycle:
Continuous variability standard of the motor rotation speed from 51 rpm to a 1500 rpm
The maximum torque is constant like showed in fig.2.1
ESV is equipped with electronic protections enabling to temporarily exceed the normal functioning limits.
Particularly: It is possible to set the working point between 100% and 200% of the nominal torque, if the requested power is lower than the nominal one (in single phase models for a time not exceeding one minute: after that immediate block will happen); over a certain time-limit the system could go in over-temperature alarm and block
Over this time the system could go into alarm for over-temperature and block
If the requested torque exceed the 200% of the nominal current ESV will block immediately.

In Fig. 2.1 it is showed the mechanical characteristic, with indications of the working areas admissible in a continuous or discontinuous way.The curve are refered to 4 poles motor.

Fig 2.1
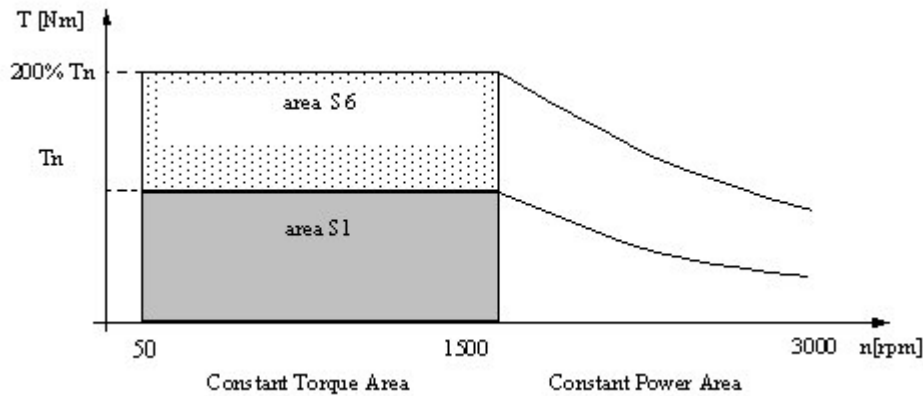
T [Nm]	torque
Tn [Nm]	nominal torque
Ts [Nm]	distributable torque in continuous service (S1)
Tmax [Nm]	maximum torque supplied with the 200% of nominal current applied to the electric motor

☞ Please note the system will block immediately : the electronic control let the shaft free to turn and it is necessary to check the effects.

☞ **ATTENTION : the ESV is not a safety device.**

2.2 *ESV DATA SHEET* (4 POLES MOTOR)

Mechanical and environmental characteristics	ESV 05	ESV 10	ESV 15	ESV 20	ESV 30	ESV 40	ESV 50	ESV 75	ESV 100
Pn [Kw]	0,37	0,75	1,1	1,5	2,2	3	4	5,5	7,5
Tn [Nm]	2.5	5,0	7,4	10,0	14,7	20	27	37	49
Ts	from zero to nominal torque								
Te	Up to 200% of nominal torque								
Tmax	200% of nominal torque								
n	50 - 1500 constant torque,1500-3000 constant power								
Δn	100 from T=0 up to Tn								
T [°C]	0° - 40°								
Electrical characteristic4T									
Supply	380 V - 15% / 460V +10% 50/60 Hz								
In [A] ms	2,1	3,5	5	6	8	10	13	16	21
Electrical characteristic2T									
Supply	220 V - 15% / 240V +10% 50/60 Hz								
In [A] ms	2,5	5	8	9	11	18	25		
Electrical characteristic2M									
Supply	220 V - 15% / 240V +10% 50/60 Hz								
In [A] ms	4,5	9	12	16	20	32	44		
EMC	Inside								
IP	IP55								

Pn [KW]   nominal power
Tn [Nm]   nominal torque
Ts [Nm]   deliverable torque in continuous service (S1)
Te [Nm]   deliverable torque overload condition (S6)
Tmax [Nm]   maximum torque
n   [min^{-1}]   speed
Δn   [min^{-1}]   maximum speed error
Jmax [kgm^{-2}]   max. moment of inertia of the load
T[°C]   temperature
In[A]   nominal current
EMC   line filter EMC
IP   protection of equipment respect to solid and liquid

3. TRANSPORT, HANDLING, STORING
3.1 Warnings

	The transport and handling of the product both packed and unpacked can be risky for the operator for the machine weight (see paragraph 2.2.1) and its mechanical characteristics.

3.2 Transport, packaging and handling.

Transport the machine only if carefully packaged and sheltered from shoves, dust and dirty.

	Before moving or packaging the machine, control box cover is correctly closed and screwed and can grant a good mechanical protection to the inner electronic card

	The handling of non packaged product, both manual and with handling systems, mustn't be made using as lifting point the control box or the metallic protection of the back cooling fan. Use only the frame or the attack flange of the motor. The risks in ESV lifting and moving must be afforded by the user in relation to the different situations. If ESV weight more than 30kg , it is necessary to use an adequate lifting device.

3.3 Deposit and storing

To deposit and store the packed product please follow the above specifications.

	ESV 05	ESV 10	ESV 15	ESV 20	ESV 30	ESV 40	ESV 50	ESV 75	ESV 100
Maximum number of stackable packaging					2				
Deposit environmental conditions				Temperature: from −10 to +80 °C Relative humidity: less than 90%. Absence of condense. Lack of dust and vibrations					
Weight of packed product[kg] (**4TS**)	9,5	13,7	17,5	21,8	29,8	32,4	43	63	65
Weight of packed product[kg] (**2TS, 2MS**)	9,5	14,7	16,5	20,8	38,5	41,2	52,1		

4. INSTALLATION
4.1 Warnings

	- The non correct installation of the device could be dangerous for the operator's safety and for the device itself. Carefully follow the assembly instructions below indicated and only refer to qualified electricians and installers. - In case of bad functioning or system block the motor is automatically led into neutral state with rotor free to round; be careful not to cause danger, in relation to the using modalities of the machine on which ESV is assembled. - The ESV are not designed to work as a brake for the load to which it is connected. If this should occur the system will block, leaving the motor in neutral state, with the rotor free to round. **Be careful not to cause danger, in relation to the using modalities of the machine on which ESV is assembled.** - The risks of the ESV use have not to be related to the machine to which it will be assembled.

4.2 Environmental using conditions

⚠️	The device external surface can reach high temperatures (higher than 60°). It is recommended to evaluate the risks on the basis of the use, the kind of environment and the atmosphere in which the device will work.

The product is due to be connected to machines working in industrial environment.
The working conditions must be compatible with:
- Protection degree IP55
- Environmental temperature variable between 0°C and 40°C .
- Relative humidity <90% ,absence of condense.
- Absence of caustic, inflammable atmosphere or at explosion risk.
- Height up to1000m (above sea level) as for the data on the plate; at higher height the return power decreases of 9% every 1000 Mt.

☞ If the working environment is particularly dusty, it is recommended to periodically clean the ventilation system. (See Chapter 7, "Maintenance")

4.3 Necessary place during the functioning

The functioning place of the device has to enable:
- A right ventilation of the motor and of the box containing the control electronic;
- An easy opening of the box upper cover an a good access to system inner regulations;

To satisfy the above specifications, it is necessary to have around the device the following place:
- Not less than 100 mm from the lateral sides of the motor's frames;
- Not less than 150 mm from the cooling fan back protection grille;
- Not less than 250 mm over the control box cover;

See fig. 4.1.
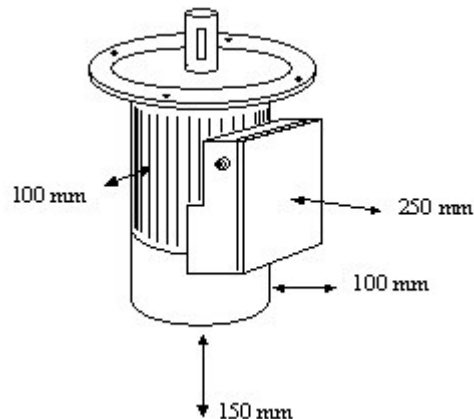
Fig. 4.1

If not possible to have distances like the ones above indicated, provide with an equivalent air volume and free circulation with external environment.

☞ However this space should enable an efficient change of air, which is absolutely necessary for the system cooling.

☞ If the working environment is particularly dusty, it is necessary to grant more space than the one indicated and sufficient to enable the periodically cleaning of the ventilation system. (See Chapter 7, "Maintenance")

4.4 Placing and installation on the spot
To install ESV in the working position there are not other prescriptions other than the ones already quoted in paragraph 4.3, "Necessary place to the functioning".
The installing procedure is the following:
1. take off the drive shaft protection plug.
2. make sure, if allowed by the application, the device placing can grant an easy access to the command and inside regulation.
3. fix the system by using the motor attack flange (for types B5 or B14) or the frame motor feet (type B3).
4. make sure the fixing screws are correctly clamped

4.5 Connection to the power supply

The system **4TS** requires a supply voltage, alternating three phase 460V +10% 380V –15% and frequency 50Hz o 60Hz in relation to the data on the plate of the specific model.The system **2TS** and **2MS** requires a supply voltagethree phase or single phase 220V -15% 240V+10% and frequency 50Hz or 60Hz .For the measurement of the electric installation and of the protection switches to be placed in the device please refer to the following table:

Tab.4.1		ESV 05	ESV 10	ESV 15	ESV 20	ESV 30	ESV 40	ESV 50	ESV 75	ESV 100
4TS	In[A]	3,5	3,5	5	6	8	11	13	16	21
	Slow blow fuse [A]	10	10	10	10	16	25	25	25	32
	Minimum section cable [mm^2]	1,5	1,5	1,5	1,5	1,5	2,5	2,5	4,0	4,0
2TS	In[A]	2,5	5	8	9	11	18	24		
	Slow blow fuse [A]	6	10	16	16	25	25	35		
	Minimum section cable [mm^2]	1,5	1,5	1,5	1,5	2,5	4	4		
2MS	In[A]	4,5	9	12	16	20	24	30		
	Slow blow fuse [A]	10	16	25	25	32	32	44		
	Minimum section cable [mm^2]	1,5	1,5	2,5	4	4	4	6		

☞ The indicated cable section is the thinnest one when their length does not exceed 30 Mt. In this way the line drop does not exceed 5% of the power voltage, as specified by the Norm EN60204-1.

☞ If ESV is installed in an implantation with ground fault interrupter, this one should be calibrated for an intervention current **not lower than 100 mA** and for a time **not lower than 0,1 s.**

☞ The ground fault interrupter should bear high frequency noise.

System electric connection procedure and preliminary check:
1. take the screw off and than the control box cover, being careful not to lose the screws and the gasket;
2. put the supply cable into the box by the proper fairled;
3. connect the ground connector to the box housing by the proper screw (indicated with the conventional ground symbol and typed with PE).
4. Connect the line phases to the terminal indicated with L1-L2-L3 (three phase version) or L-N (single phase version)
5. Check that all the terminals are well clenched and the wires are steady blocked;
6. Steadily block the cable in its seat by clenching the fairled;
7. Check the motor power size is well set on the configuration switches of the electronics card.
8. Check that objects weren't left for chance inside the box;
9. Close again the box cover by correctly placing the gasket and carefully clenching all the screws;
10. Supply the system;
11. Check that the cooling fan work in the right way;
12. Switch the system off.

⚡ ESV must be connected to the sources of electric energy by respecting the rules in force about plant engineering and in the building (EN60204-1 on the machine).

4.6 Installation

The user/installer has the responsibility for the safety of his construction, according to the norms UE and national rules. The safety indications in this manual are due to this aim, but they are only about ESV and its use.
For over temperature and over loading see par. 5.2 and 6 .

☞ During the first test, start ESV with the plastic protection on the drive shaft, because the key can be thrown out for centrifugal force and cause huge damages.

While functioning check that the installation do not present too many vibrations. On the opposite, turn ESV off and verify that the coupled organs are well balanced and the base is solid.

If while working ESV is too noisy, check the bearings are not weared and need to be replaced (par. 7.4).
Before installing ESV it is recommended to check the general state; particularly check the right functioning of the mechanical organ, and most of all the rotation smoothness of the drive shaft. Compare the technical data and the specifications on the allowed use in this manual, in the plate data and in any other documentation enclosed to the item with the right characteristics.
Respect the general indications about good manufacture and preventional technique, the local rules and the machine specifications.
Verify that all electric terminals in the terminal board are well connected, that the voltage and frequency value on the plate are the same of the power supply, from which ESV will be supplied. Otherwise the installation is forbidden.

5. MACHINE USE

5.1 Warnings

	■ It is recommended to use ESV exclusively with the control box cover correctly closed and screwed. ■ The voltage levels inside the control box are EXTREMELY DANGEROUS. Before opening the cover, disconnect all the conductor phase of the system. ■ Wait at least five minutes because the inner voltages reach value for the operator's safety. ■ Make sure all led are switched off. ■ When closing the control box and before supplying the system, make sure that objects weren't left inside it **The non respect of these safety norms could be very dangerous for the operator and cause irreparable damage to the system.**
	Don't remove the back protection of the cooling fan.

5.2 Safety systems.

ESV is provided with the following inner electronics protections:
- **Temperature protection for the electronics**: it causes the system block if the temperature inside the control box exceeds the allowed safety limit. This can happen if the system works over the nominal power of the motor, over the nominal torque
- **Protection of the maximum torque**: it causes the immediate block, if required to ESV a torque more than 200% than the nominal one.
- **Overloading protection**: it causes the system block if requested to ESV a couple of 200% higher than the nominal one, for 30s of work (tl) each 20 min (the time of cycle tc). (or equivalent). As specified by two following figures (fig. 5.2.1 and fig. 5.2.2).
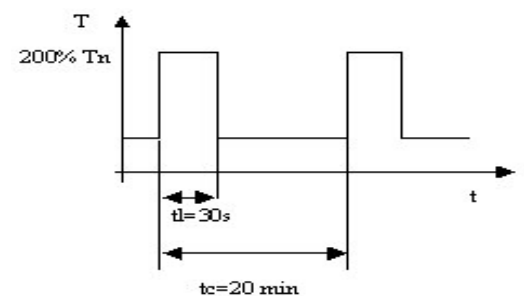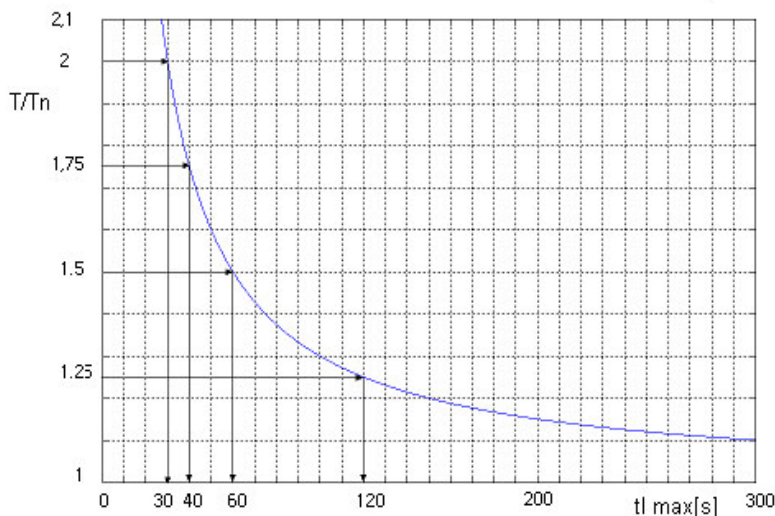
fig. 5.2.1

fig. 5.2.2

The procedure from to avoid the overloading is the following:
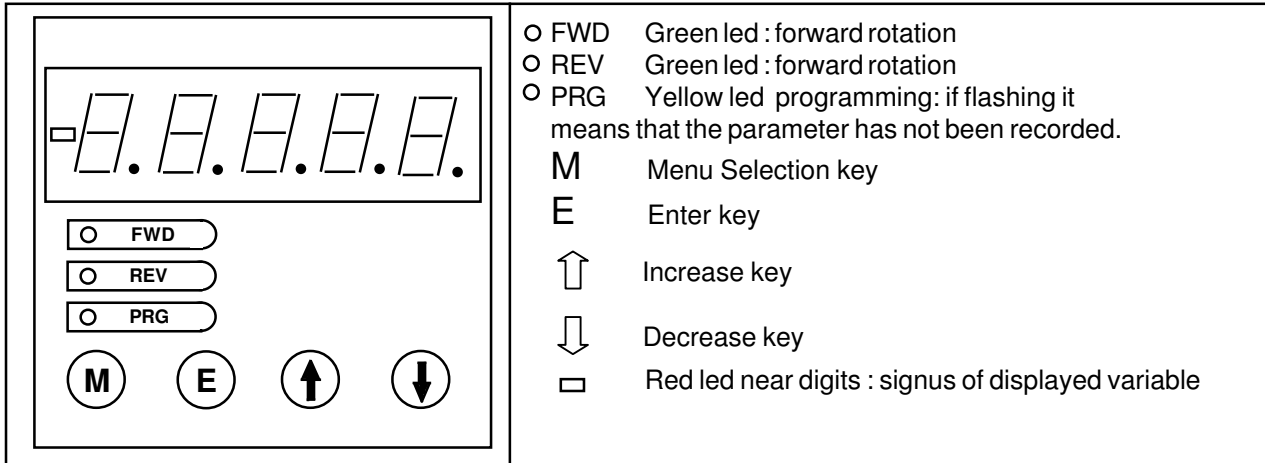1. check the work time (tl[s]) time the requested torque T (T>Tn; if it is requested less torque or equal the motor can work at continuos service) is lower or equal regarding diagram on figure 5.2.1 (tlmax[s]),
2. compute cycle time (tc[min]) with the formula : tc[min]=0.7 tl[s]
Note: Time unit are different: tl and tc are rispectly seconds [s] and minuts [min]

5.3 Control, regulation and signalling systems.

ESV control system has been realised by means of control signals available in the interface connectors and in the control keyboard.

Control keyboard and display ESV TST-M description

O FWD	Green led : forward rotation	
O REV	Green led : forward rotation	
O PRG	Yellow led programming: if flashing it means that the parameter has not been recorded.	
M	Menu Selection key	
E	Enter key	
⇧	Increase key	
⬇	Decrease key	
▭	Red led near digits : signus of displayed variable	

ESV MENU

d.xxx Parameter's Menu: only for reading (displaying of Electronic variator's status).See Appendix 9.2 for explanations

S.xxx Start-up Menu : parameter read and write for simple applications.

F.xxx Frequency Menu : parameter frequency management for advanced applications.See STM web site and download the manual file .

I.xxx Interface Menu: configuration input and output digital and analog.

P.xxx Parameter menù .For advanced application .See STM web site and download the file.

A.xxx Applications menu.For setting special feedback system.See STM web site and download the file.

C.xxx Command menu.Special commands.See STM web site and download the file.

H.xxx Hidden menu.Concerns serial communication and field bus.See web site STM and download the file.

PARAMETER'S MODIFING PROCEDURE

1. Take out the jumper from the connector IO1 (4 and 5 pin)
2. Select the parameter to be modified by M menu key and arrows (↑ e ↓).
3. Press the enter key (E): it will be displayed the actual parameter value. NOTE: if the yellow led is on, you will go on modifying the parameter.
4. To modify the parameter use the the arrow keys for increasing or decreasing the variable.
5.   Press enter key (E) to confirm.You see the statement of parameter.

PARAMETER'S STORAGE PROCEDURE

1. Press menu key M and select the start-up menu **S.xxx.**
2. Select **S.900**.
3. Confirm with enter key (E). NOTE: the storing is made only if yellow led is on.
4. Select the arrow up(↑).You see **do**.
5. Confirm with enter key E : on display appears **runn** and after **done** that indicate end operation.
6. Insert the run jumper on IO1 connector between 4 and 5 pin.

BASIC PROGRAMMING

Here it is described the basic programming using the Start-Up menu.For advanced application see STM web site and download the manual file.

START-UP MENU

Code	Description	Variation range	Variation unit and E measure unit	Def.	**IPA**
S.000	nominal main voltage	230 -480	V	380	404
S.001	nominal main frequency	50,0 - 60,0	0,1 Hz	50,0	405
S.100	maximum reference frequency	25 /500	1HZ	50	305
S.101	minimum reference frequency	0-S.100	1HZ	1,7	306
S.110	Reference 1 Source	0-8	1	5	307
S.120	Motopotenziometer reference:speed regulation with key	-9999 TO 99999	rpm	51	343
S.121	Motopotenziometer minimum	0-50	Hz	1,7	302
S.122	Motopotenziometer monopolar / bipolar	0=MONOP./1=BIP.	1	0	303
S.123	Motopotenziometer with auto save	0=NOT SAVE / 1=SAVE	1	1	304
S.130	Digital Reference frequency 0	-S.100 TO S.100	Hz	0	311
S.140	An Input 1 configuration	0-2	1	1	118
S.200	acceleration time 1	0,1 TO 999.9	sec	3	329
S.201	deceleration time 1	0,1 TO 999.9	sec	3	330
S.300	Commands source selector	0-4	1	1	400
S.310	Command logic for Run-Rev signal	0=RUN-REV/1=FWD-REV	1	0	401
S.311	Safe start	0=START WITH RUN CONTACT CLOSE AT TURN-ON / 1=NOT PERMITTED	1	0	403
S.312	Stop mode	0=WITH RAMP/1=INERTIA	1	0	493
S.320	Default rotation reverse *	0=CLOCKWISE / 1=COUNTER CLOCKWISE	1	0	502
S.800	Speed conversion constant for display (mantissa)	0,01-99,99	0,01	1	489
S.801	Speed conversion constant for display (exponent)	-4 TO -1	1	0	496
S.802	Speed unit selection	0-3	1	3	497
S.810	Display IPA at start up	1-1999	1	343	488
S.900	Permanent storage of all parameters				800
S.999	menu' enable mask	0000-FFFF	1	0003	500

IPA field at last column is the number associated to every parameter : this number identifie the parameter.

* To know the rotation sense see motor flange and observe the shaft rotation (clockwise or counterclockwise)

Parameter S.810

The parameter S.810 display parameter at start.
The value is IPA of parameter to display at start.

S.810=343 for default , at start display the parameter S.120 , the reference speed with motopotentiometer (using arrow key ↑ and ↓).
To display output speed with user unit (d.007) set S.810= 8.
To display output reference speed with user unit (d.008) set S.810=9.
To display estimation speed motor with user unit (d.009) set S.810=62.
To display output frequency (d.000) set S.810=1.
To display reference frequency (d.001) set S.810=2.
To display output current (d.002) set S.810=3. And so on.

5.3.1 Start and stop operations

OPERATIVE PROCEDURES

The setting up of S.110 e S.311 parameters have four main operative modes:
1.   MODE O1 : the configuration is the following   S.110=5 and S.311=0
-   Speed regulated from keyboard with arrow keys.
-   Run when turn-on power supply
-   Stopping with inertia when power supply is turn-off.
2.   MODE2 : the configuration is the following S.110=5 and S.311=1
-   Speed regulated from keyboard with arrow keys.
-   Run when remote contact is close (pin 4-5 of IO1 connector) .
-   When the remote contact is open, ESV stops .
3.   MODE3 : the configuration is the following S.110=1 and S.311=0
-   Speed regulation with remote potentiometer.
-   Automatic run-gear when 400V starts.
-   ESV   inertial stop when 400V is turn-off
In order to display the speed at the start, the configuration is :
S.802=9 and save parameter with S.900 , Enter , Arrow-up , Enter
4.   MODE4 : the configuration is the following S.110=1 and S.311=1
-   Speed regulation with remote potentiometer.
-   Run when close remote contact is close (pin 4-5 of IO1 connector).
-   ESV stops when the remote contact is open
If you need display at start , program like mode3 .

5.3.1 Reference speed with parameter S.110

Value	Description	Value	Description
0	Nothing	5	Motopotenziometer (S.120)
1	Analog input 1 (for example. external potenziometer)	6	Reserved
2	Analog input 2	7	Signal encoder reference
3	Reference frequency (S.130)	8	Field Bus reference(Profibus and others)
4	Multispeed:frequencies presetted and selected with digital input		

The regulation speed by analog input 1 can be have the following mode:

S.110		Description
1	Jumper J1 not insert; I.200=1(default)	Control speed by analog input 1 REF-V(0/10V)
1	Jumper J1 not insert; I.200=0	Control speed by analog input 1 REF-V(-10/+10V).The signus voltage decide the sense of rotation
1	Jumper J1 insert; I.200=1	Control speed by analog input 1 current drived 0-20mA REF-I
1	Jumper J1 insert; I.200=2	Control speed by analog input 1 current drived 4-20mA REF-I

Note.To regulation speed with analog input 2 the table is analog. Must be setted I.210 and J2.

5.3.3 Ramp regulation acceleration

<table>
<tr><td>⚡</td><td>Do not absolutely make system regulation operations with the box open and the device electrical supplied.</td></tr>
</table>

The regulation of time acceleration (and deceleration) ramp is obtained with S.200 and S.201.

5.3.4 Movement enabling

<table>
<tr><td>⚡</td><td>Do not absolutely regulate the system when the box is open and the device is supplied.</td></tr>
</table>

The run-gear key has to be considered as a motion permission or as function starting up of the device. This happens by means of an in-line switch or by means of a control signal, using the specific I01 interface cable

<table>
<tr><td>⚠</td><td>The state of disabled device mustn't be considered as a safety one, in which operating special regulation or maintenance activities or other.
To reach a safety status, verify that all phase conductors to the system have been disconnected for at least five minutes.</td></tr>
</table>

5.3.5 Selection of the direction

<table>
<tr><td>⚡</td><td>Do not absolutely make operations of system regulation when the box is open and the device is supplied.</td></tr>
</table>

The direction command can be realized by means of a remote key, using the REV signal of remote I01 cable or by means of S.320 parameter.

5.3.6 Wiring braking resistance.

<table>
<tr><td>⚡</td><td>Do not absolutely set the system regulation when the cover box is open and the device is supplied.</td></tr>
</table>

Connect to the faston plug on the power schedule as underlined by the Rbr serigraphic writing. The minimum values are specified on the following scheme.
Don't use value under minimum, you can damage devices.

Model	Minimum limit of the braking resistance
ESV05 4TS/ESV10 4TS	100 ohm /200Watt
ESV15 4TS/ESV20 4TS	100 ohm /200Watt
ESV30TS/ESV40TS/ESV50TS	75 ohm/350Watt
ESV75 4TS/ESV100 4TS	50 ohm/600Watt / 25ohm/600Watt

5.4 REMOTE CONTROL INTERFACE FOR ESV-CONNECTORS INPUT OUTPUT – OPTION JUMPER SELECTION

INPUT OUTPUT SCHEMATIC

Signals disposition on the connectors of the control card (generic male connector seen from above). Each connector is supported by a serigraphy which enable you to identify the connector itself. Each connector's pin is associated to a number, a signal and a colour as explained in the following diagrams and tables:
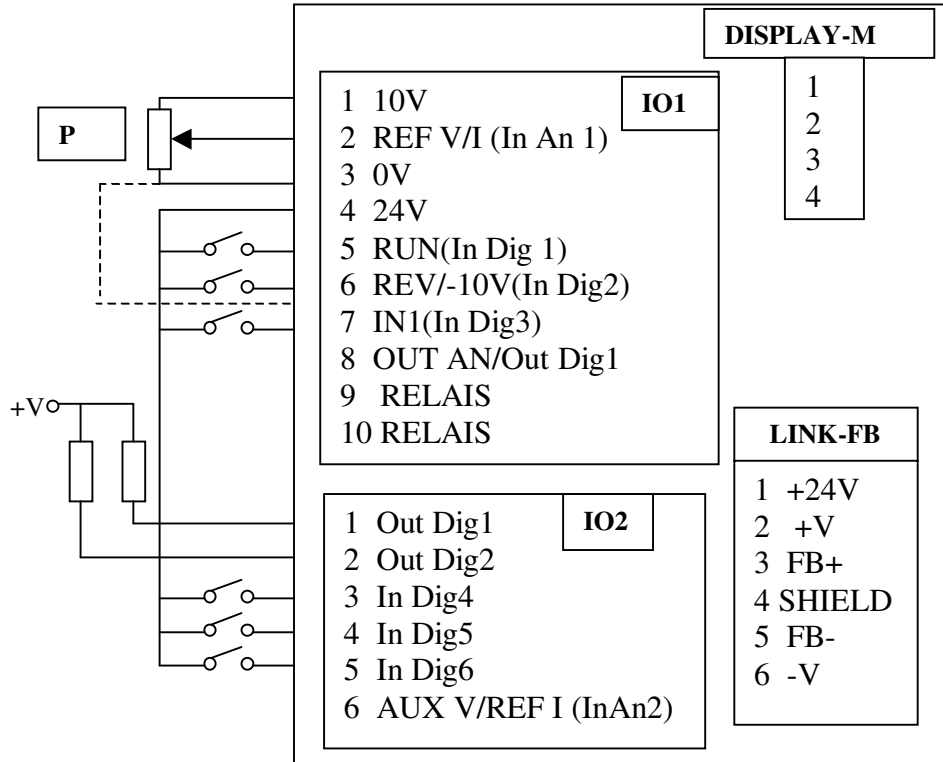
REMOTATION CABLE SIGNAL IO1

Pin	Colour	Signal	Function
1	Pink	10V	Potentiometer voltage for speed reference
2	White	REF V/I (In An1)	Speed reference
3	Yellow	0V_AN	Common
4	Grey	24V, 300mA	Output for feed sensors
5	Green	RUN(In Dig 1)	Run input
6	Brown	REV (In Dig 2) or -10V	Inversion input/-10V for speed reference. Selection by jumper (see serigraphs REV/-10V)
7	Blue	In Dig 3	Configurable Digital input.
8	Red	OUT AN or Out Dig1	Analogic output 0/10V/Configurable digital output. Selection by jumper (see serigraphs O.A/O.D1)
9	Black	RELAIS	Relais contact for alarm signal .Selection
10	Violet		NO o NC by jumper (See serigraphs R.NO/R.NC)

REMOTATION CABLE SIGNAL IO2

Pin	Colour	Signal	Function
1	Grey-pink	Out Dig1	Configurable digital output (open collector, Vmax=50V, Imax=50mA)
2	Red-blue	Out Dig2	Configurable digital output (open collector, Vmax=50V, Imax=50mA)
3	White-green	In Dig 4	Configurable digital input
4	Brown-green	In Dig 5	Configurable digital input
5	White-yellow	In Dig 6	Configurable digital input
6	Brown-yellow	AUX V or REF I (In An2)	Configurable analogic input/Reference current input for speed reference (0-20mA o 4-20mA)

LINK-FB CONNECTOR FOR SERIAL COMMUNICATION (Field Bus)

Pin	Colour	Signal
1	Pink	+24V
2	White	+V
3	Yellow	FB+
4	Grey	SHIELD
5	Green	FB-
6	Brown	-V

The pins 2 (V+) and 6 (V-), are the differential supply user side. The value is definied by plug-in board interface.
The pins 3 (FB+) and 5 (FB-) , are differential input/output protocol definied by plug-in board interface.
Pin 4 is cable shield connected to internal ground , through parallel resistor 1M ohm and a condenser 1 nF value.
The pin are optoinsulated.

DISPLAY-M CONNECTOR
An extention connection allows the display connection if the following indications are respected:

Pin	Colour	Signal	DB9 FLASH TST
1	White	+5V	6 or 9
2	Red	Tx	1
3	Green	Rx	2
4	Black	Gnd	5 or 8

Note:
- The active digital outputs must be considered as switches that switch to 0V, so that the load is connected between +V and the output (+Vmax=50V, Imax=50mA).
- The inputs are active if switched at +24V.
- External fault (EF) funtion can be programmed by means of digital inputs. Jumpers you can find on the control card near to the connectors I/O select some signals of I/O.

In the following table you can find all possible configurations.

Jumpers you can find on the card near to I/O connectors select some I/O signals. In the following chart you can find all possible configurations:

Serigraphs	Signals
REV/-10V	Reverse/-10V
O.A/O.D1	Analogic Output / digital output 1
R.NO/R.NC	Normal open relais contact / Normal closed relais contact
J1	if inserted InAn1 the reference is current else ,is not inserted, it is voltage (default)
J2	if inserted InAn2 the reference is current else ,is not inserted, it is voltage (default)

SIGNAL CONNECTOR
Below the top view connector .
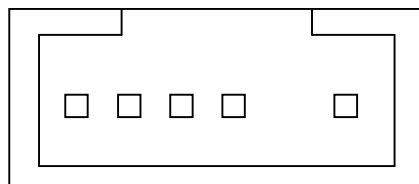
1   2   3   4   n

6. DIAGNOSTIC AND INTERVENTION

Almost all the operations of functioning and diagnosis check of the device do not require to open the control box. If absolutely necessary to open box, before opening the cover, disconnect all the system phase conductors and wait at least five minutes because the inner voltage reach the value for the operator's safety. In any situation, please check that:
- the conductors are disconnected and placed under the maintainer control .
- all mechanical masses, kinematically connected to the shaft drive are fixed and that sudden starts can't succeed for the dragging of the shaft drive from external mechanical organs.

In case of failure or bad functioning, ESV signals by the display the code error.For some alarm it is possible the reset:1)manual reset : push both the arrow key.2)by signal : program a digital input for this function.

⚠	**If alarm occur ESV electronic control let free to turn the motor shaft. Pay attention every consequential risk of danger for people or devices.**

Code	Description , causes and solutions
OC	**Over Current protection**: it is activated when current goes over the maximum threshold in order to protect the electronic board. **Causes** 1)load torque too high 2)start torque too high 3) the brake ,if present, is locked 4)phase motor short-circuit and towards earth. **Solutions** 1) 2)read parameter d.002 and try to increase time acceleration 3)check the brake intervention and set the timing with P.310 and P.311 4)call STM service. (autoreset is possible)
OU	**Over Voltage Protection**: occours when the voltage of BUS-DC it is higher of programmed threshold. **Causes**: 1)deceleration time too short 2)the load drag the motor (for example during change speed and load with great inertia) 3)verify damage of braking resistance, if present.**Solutions** 1)increase time acceleration 2)use the brake resistor 3)if it is present a brake resistor check is not damaged. Alwais read d.004 to measure BUS-DC voltage. (autoreset is possible)
UU	**Undervoltage**: it is activated when the BUS-DC voltage is under the minimum threshold programmed in order to prevent ESV from wrong performances caused by torque limitation. P.342=0 disable the alarm recording. **Causes** : voltage line falling down **Solution** : read d.004 , try to change threshold with parameter P.340,P.341, P.343.If you dont solve problem contact STM service. (autoreset is possible)
OH	**Over Temperature protection**: it is activated when heatsink temperature goes over the maximum threshold in order to protect the electronic card. Autoreset is not possible.**Causes** : 1)external temperature too high 2)cooling forced damaged 3)cooling forced occlused 4)duty cicle too high in autobrake version **Solutions** : 1) 2)contact STM service 3) clean fan 4)contact STM service (autoreset is not possible)
OLi	**Electronic board overloading protection**: it is activated when steady-state current and the time are higher the maximum limit (Ixt or Txt where T=torque).This alarm consent to protect the electronic board.The current limit is refered to the electronic board. Autoreset is not possible.**Solutions**: read the absorbtion current (d.002) and evaluate to increase the board size. (autoreset is not possible)
OLM	**Motor overloading protection**: if setted P.260=1 , it is activated when steady-state current is more than maximum threshold for the maximum time limit (I^2xt or T^2xt where T=torque) in order to protect the motor. Levels are based on rated value motor . (autoreset is not possible) **Causes** : eccess of absorbtion motor current. **Solutions**: read the absorbtion current (d.002) and evaluate the following 1)increase acceleration ramp 2)set "S" ramp 3)increase motor size. (autoreset is not possible)
Olr	**Protection against resistance braking overloading**:if enabled (P.280=1) the alarm occur when power on braking resistance is more than rated power time the thermal constant. Levels are setted by parameters. Autoreset is not possible.**Causes**: wrong setting parameter or brake resistor damage **Solutions** : check setting parameter of brake resistor management, brake resistor perfect functioning (autoreset is not possible)
Ot	**Over Torque Motor** : active when is setted (P.240) , detect overtorque conditions programmed (P.241,P.242,P.243).**Solutions:** check overload conditions before restart and when run (d.002) comparing with alarm threshold.(Autoreset possible only for sw version 09.02 and following **) (autoreset is not possible)
Ph	**Protection against the loss phase**: active after 30 seconds a phase loss, (P.410=1).**Causes**:loss of one phase **Solutions** : 1) check the presence of all phases,one phase can be disconnected 2) read the voltage : correct value is d.004=Vrms*1,41 if less the minimum voltage occur alarm. If ESV is 230Vac single phase supplied set P.410=0 . (autoreset is not possible)

(**)check sw version reading d.951

Code	Description , causes and solutions
EF	**External Fault**: occur when a digital input is programmed like "External Fault NO" or "External Fault NC" and the input is active. (Autoreset is possible)
FU	**FUse** : indicates break fuse input. **Solution** : Call Service STM (Autoreset not possible)
OCH	**Over Current IGBT** module or instantaneous over current.**Solutions**: check load condition(Autoreset is possible)
St	**Serial time-out**: occur when the time is greater threshold setted by parameter I.604.(Autoreset is possible)
OP1	**OPtion1** : occur when communication between ESV and expansion board OP1 goes on fault state. **Solution**: 1)Check communication line and expansion board.2)Call Service STM (Autoreset not possible)
OP2	**OPtion2** : occur when communication between ESV and expansion board OP2 goes on fault state. **Solution**: 1)Check communication line and expansion board.2)Call Service STM (Autoreset not possible)
bF	**Bus Fault** : occur when communication between ESV and expansion board Field Bus goes on fault state.**Solutions**: 1)Check communication line and expansion board.2)Call Service STM (Autoreset not possible)
OHS	**Over temperature sensor** : occur when the temperature sensor is greater threshold.Reset and Autoreset not possible.(***)
Lf	**Limit fault** Occur when ESV is on limit condition cause output current or Dc-Bus voltage.Can happen if setting parameter are wrong or overloading motor (Autoreset not possible)
SHC	**SHort Circuit** : occur when a short circuit between output and motor phase.(Autoreset not possible)
Lou.U	**Low voltage Dc bus** : occur when Dc bus is lower of minimum on start-up phase.**Solution**: turn-off and turn-on.If alarm remain contact STM service. (Autoreset not possible)
Mb	**Mains Break** : main power line loss.Call Service STM
PE	**Parameter Error** : error on start-up phase,loading parameter setting by user. **Causes** : can occur if saving data from KEY and turn off before end saving **Solutions** : manual reset , or serial reset. If error message missing when saving (S.900) are stored default data.Then reprogram and saving data.If alarm appear contact STM service.
P.C.Ex	**Power Configuration Error** :error on configuration power loading.Call Service STM. (*)See note below. (Autoreset not possible)
r.C.Ex	**Regulation Configuration Error** : error on configuration regulation loading.Call Service STM.(*)See note below. (Autoreset not possible)
P.F.Ex	**Parameter File Error** : error on parameter file loading. Call Service STM. (*)See note below. (Autoreset not possible)
S.F.Ex	**Start-Up File Error** : error on menu Start-Up file loading.Call Service STM. (*)See note below. (Autoreset not possible)

(*) x is a numerical code that specifies the error type
(**)check sw version reading d.951
(***) threshold temperature of sensor OH alarm and OHS alarm (between 75°C and 85°C) depending by size

⚠	In case of non functioning or system fault the motor's system is disconnected and the rotor is free to round; be careful this behaviour and the use modalities of the machine to which ESV is assembled cannot cause dangerous situations.

7. MANTEINANCE

7.1 Warnings

⚠	The user cannot maintain or repair ESV components. In case of damages or functioning problems contact the authorised service only.

7.2 Cleaning and ordinary maintenance

The only ordinary maintenance ESV requires is the periodical cleaning check of the cooling system.
This operation must have a monthly frequency if the device works in normal environmental conditions and weekly or more frequently it works in particularly dusty rooms or which cause the deposit of substances that could reduce the cooling system efficacy

☞	During the maintenance and cleaning operation make sure the control box cover and the fairled of the supply cable are fixed in the right way, not to let dust and dirty enter the device, causing possible problems to the electronics.

For ordinary maintenance follow this **procedure**:
1. Disconnect ESV from power line ;
2. Check all the motor's side cooling fin, the fan back protection grid and the cooling fins in the back side of the control box are free from dust deposit, rubbish, dirty;
3. On the opposite clean them by using torns or compressed air with medium pressure. In extreme cases wash the device with a weak jet of water, letting then it dry;
4. Supply the system again;
5. Check the cooling is easy inside all the cooling fins, otherwise clean it again.

7.3 Periodical inspection

It is recommended to make it periodically, according on using conditions and however at least monthly:
a. Maintenance of the free ventilation space (par. 4.3).
b. Motor cleaning (par. 7.2).
c. Quality of wiring connections (par. 4.5).
d. Check of the right and solid connection of the motor to its mechanic load.

If between the supply and the start up have passed more than 4 years but in good storing conditions (dry environment and free from dust and vibrations), or more than 2 years in bad conditions, it is due to replace the motor bearings.

The motor moist must be taken away by using an external heating.

7.4 Replacing of bearings or other spare parts.

Contact STM, avoiding disassembling.

8. PLACING OUT OF SERVICE

In case ESV is not working any more and it is thrown away, please note that:
- There is an explosion danger of the electrolytic condensers inside the control box if the product is kept at high temperatures, (like in incinerators);
- The plastic material could release, if burned, venomous gases and very toxic;
- ESV is considered as a «special, non dangerous» product for UE laws. It is necessary to dispose it following the local norms and regulations.

9. Appendix

9.1 Motopotentiometer Parameters

The parameter S.120 is the motopotentiometer reference. The default at ESV starting you have the speed reference by motopotentiometer. Using the the key arrow $\uparrow$, $\downarrow$ .change the speed.
The speed is displayed in different unit measure : 1) rpm 2) frequency applied to the motor 3)speed of the load.
Making a scale you can display the output speed of gear box or other kind of load modifiing the following parameters.
You can choose the unit measure with the parameter S.802 (default S.802=3) :

S.802	Measure Unit	Output display
0	Hz	F.000
1	Hz	F.000 x S.800 x 10 ^ (S.801)
2	rpm	F.000 x 60 / P.041
3	rpm	F.000 x 60 / P.041 x S.800 x 10 ^ (S.801)

F.000 is frequency applied to the motor. P.041 is motor pole pairs (4 poles P.041=2, 2 poles P.041=1) .
It is possible scaling the display speed with two parameter: S.800 (mantissa) and S.801 (exponent).

The decimal digit number displayed are setted with S.801:

S.801	Decimal digit displayed
1	1
0	2
-1	2
-2	2
-3	3
-4	4

For ex.if I have a gear box with ratio 1:50, I have 1 output turn every 50 motor turn: 1/50=0,02=2*10^(-2) then I set S.800=2 and S.801=-2.
Example If I have a gear box 1:100 1/100=0,01=1*10^(-2) then I set S.800=1 and S.801=-2
If the value to display is higher than representible, are eliminated the decimal digits.
If the value is not representible with elimination of decimal digits are displayed "----" like overflow conditions.
Pay attention that the unit is the same of F.000 (default 0,01Hz) therefore if you touch the key you have great variation of displayed value or at the opposite very little variation.
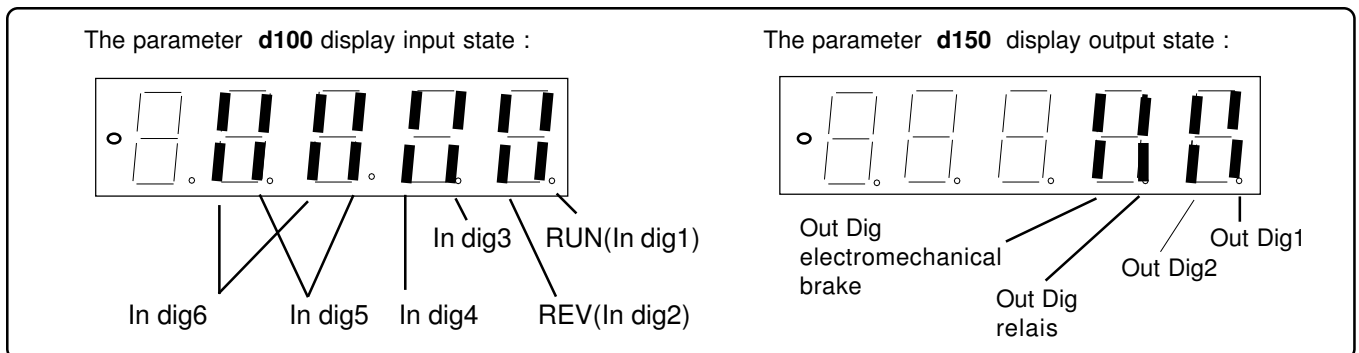Parameter default are S.800=1 S.801=0 S.802=2

9.2 Display Menu'

Code	Description	Measure Unit	IPA
d.000	output frequency	Hz	1
d.001	reference frequency	Hz	2
d.002	output current (rms)	A	3
d.003	output voltage (rms)	V	4
d.004	DC-Link voltage (BUS-DC)	V	5
d.005	cos phi (Power factor)		6
d.006	electrical output power (real power)	KW	7
d.007	output motor speed (d.000*S.800*10^(S.801))	(*)	8
d.008	set point motor speed (d.001*S.800*10^(S.801))	(*)	9
d.009	estimated speed	(*)	62
d.050	heatsink temperature	°C	10
d.051	inverter overload (100% = alarm threshold)	%	11
d.052	motor overload (100% = alarm threshold)	%	12
d.053	braking resistor overload (100% = alarm threshold)	%	13
d.054	electronic board temperature	°C	58
d.100	Drive digital command monitor		14
d.101	Terminal digital command monitor		15
d.102	Virtual digital command monitor		16
d.120	Exp drive digital command monitor		17
d.121	Exp terminal digital command monitor		18
d.122	Exp virtual digital command monitor		19
d.150	Drive digital state monitor		20
d.151	Terminal digital state monitor		21
d.152	Virtual digital state monitor		22
d.170	Exp drive digital state monitor		23
d.171	Exp terminal digital state monitor		24
d.172	Exp virtual digital state monitor		25
d.200	Analog inp 1 configuration monitor:Display actual setting [0] not programmed [1]frequency reference 1 (S.110) [2]frequency reference 2 (F.051) [3]boost regulation (P.121) [4] overtorque regulation (P.242) [5]output regulation voltage (p.422) [6]D.C. braking current (P.301) [7]extension ramp factor (F.260)		26
d.201	Drive analog inp 1 monitor	%	27
d.202	Terminal analog inp 1 monitor and I.200 values: [0] with Jumper on J1 connector: +/-10V , 0V=0%, -10V=-100%, 0V=100% [1] without jumper on J1 : 0-10V, 0V=0%, +10V=+100% with Jumper on J1 : 0-20mA: 0mA=0%, 20mA=+100% [2] with Jumper on J1 : 4-20mA: 4mA=0%, 20mA=+100%	%	28
d.210	Analog inp 2 cnf monitor.See d.200		29
d.211	display percent value of block output signal of analog input 2	%	30
d.212	Terminal analog inp 2 monitor and I.210 values: [0] with Jumper on J2 connector: +/-10V , 0V=0%, -10V=-100%, 0V=100% [1] without jumper on J2 : 0-10V, 0V=0%, +10V=+100% with Jumper on J2 : 0-20mA: 0mA=0%, 20mA=+100% [2] with Jumper on J2 : 4-20mA: 4mA=0%, 20mA=+100%	%	31
d.220	Reserved		32
d.221	Reserved		33
d.222	Reserved	%	34
d.250	Display percent odn of scale for analog output associated		63
d.260	Reserved		64
d.270	Reserved		65
d.300	read encoder pulses sampled(see I.504)	Hz	35
d.301	encoder frequency (frequency motor)		36
d.302	encoder speed (d.301*S.800*10^(S.801))		37
d.350	opt1 State		38

(*) See parameter P.602

| Code	Description	Measure Unit	IPA
d.351	opt2 State		39
d.352	16-bit parallel port state (option not actually implemented)		40
d.353	Sbi=>PLC State		59
d.354	Sbi=>PLC Baudrate	%	60
d.400	Block PID reference	%	41
d.401	Feedback PID	%	42
d.402	Error signal PID	%	43
d.403	PID integral component	%	44
d.404	Output PID block		45
d.800	Last alarm stored		46
d.801	Second to last alarm stored		47
d.802	Third to last alarm stored		48
d.803	Fourth to last alarm stored		49
d.950	Current rated board		50
d.951	Software version part 1		51
d.952	Software version part 2		52
d.953	identification power code		53
d.954	identification parameter code		54
d.955	identification regulation code		55
d.956	identification start-up code		56
d.957	drive size		57
d.958	Drive cfg type : 0=400V standard , 1=reserved		61
d.999	display test:all segments and dots must be lighting		99

SBI Serial Bus Interface : is the optional electronic board for field-bus communications
Virtual : command by serial line and field bus

The parameter **d100** display input state :

In dig6   In dig5   In dig4   REV(In dig2)   In dig3   RUN(In dig1)

The parameter **d150** display output state :

Out Dig electromechanical brake   Out Dig relais   Out Dig2   Out Dig1

9.3 ACCESSORIES

PROGRAMMING KEY   [code KM-PRGE]

The programming key device allows for transfer parameters configuration from and to the ESV .The switch put on latch closed position allows to write protect the stored data. In order to make transfer operation the input RUN must be in stop position (contact open).
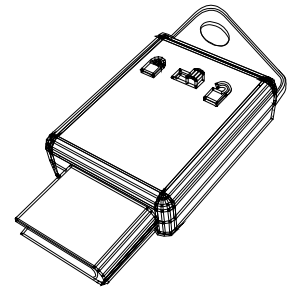
Download data from the ESV to the key KM-PRGE:

Check the software version : go to parameter d.951
if d.951=09.01 or 09.02 or 09.03 or 09.04   follow this procedure:
push M two time quickly (to go out of d.xxx menu)
set   S.999=01FF (push E and you find 0003, then push arrow up to change the numerical value up to 01FF)
push E   (led PRG lighting)
plug the key KM-PRGE into connector
then change menu up the parameter **C.041**, push Enter ,arrow up and Enter.
go to S.999 and set   S.999=0103
push E
Saving parameter configuration
go to S.900
push E (appear off)
push Arrow up (appear do)
push another time E (appear runn and done)

**Download data from the key KM-PRGE to the ESV:**

push M two time quickly (to go out of d.xxx menu)
set   S.999=01FF (push E and you find 0003, then push arrow up to change the numerical value up to 01FF)
push E   (led PRG lighting)
plug the key KM-PRGE into connector
then change menu up the parameter **C.040,** push Enter ,arrow up and Enter.
go to S.999 and set   S.999=0103
push E
Saving parameter configuration
go to S.900
push E (appear off)
push Arrow up (appear do)
push another time E (appear runn and done)

REMOTATION CABLES OF SIGNAL   COMMAND

Cable with connector type IO1 of principal signals. Cable lenghts available :   1, 3, 5, 10 m
Cable with connector type IO1+IO2 .Lenghts: 1, 3, 5,10 m
Cable with connector type LINK-FB for FIELD-BUS communications
Cable with connector type DISPLAY-M to remote   FLASH TST . Lenghts 1, 3, 5,10 m
Connector AMP type 280362/0 used for IO1
Connector AMP type 280360/0 used for IO2 and LINK-FB
Connector AMP type 280359/0 used for DISPLAY
Contact AMP type 280708/0 to assemble previous connectors
Potentiometer   5 Kohm linear

FLASH LNK remote keyboard: display and change parameter for long distance.Command start-stop.Must be installed with Plug-in RS485

FLASH TST remote keyboard : display and change parameter for short distance.Command start-stop
Dimensions : front 104X75 , rear hole 87X65
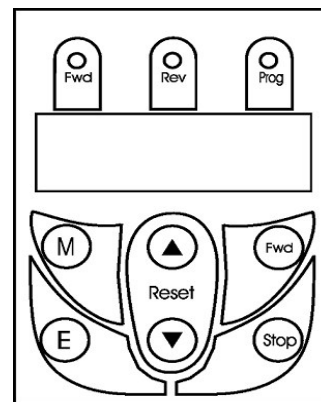
FIELD-BUS COMMUNICATIONS

-Plug-in RS485 : software protocol MODBUS and FOXLINK
-Plug-in CANBUS : software protocol CANOPEN and DEVICENET
-Plug-in PROFIBUS : software protocol PROFIDRIVE and PROFIBUS-DP