GSP

phytron®

Stepper Motor Power Pack with Axis Controller

Manual 1128-A007 GB

customized solutions *in motion*

GSP

Stepper Motor Power Pack

with Axis Controller

Phytron-Elektronik GmbH

Industriestraße 12

82194 Gröbenzell, Deutschland

Tel.: +49(0)8142/503-0

Fax: +49(0)8142/503-190

Every possible care has been taken to ensure the accuracy of this technical manual. All information contained in this manual is correct to the best of our knowledge and belief but cannot be guaranteed. Furthermore we reserve the right to make improvements and enhancements to the manual and / or the devices described herein without prior notification.

We appreciate suggestions and criticisms for further improvement. Please send your comments to the following
E-mail address: info@phytron.de

Table of Contents

1 GSP

In this chapter you will find a brief description of the GSP positioning module and a schematic diagram.

1.1 Short Overview

The GSP POWER PACKS are intelligent positioning modules for two-phase stepper motors.

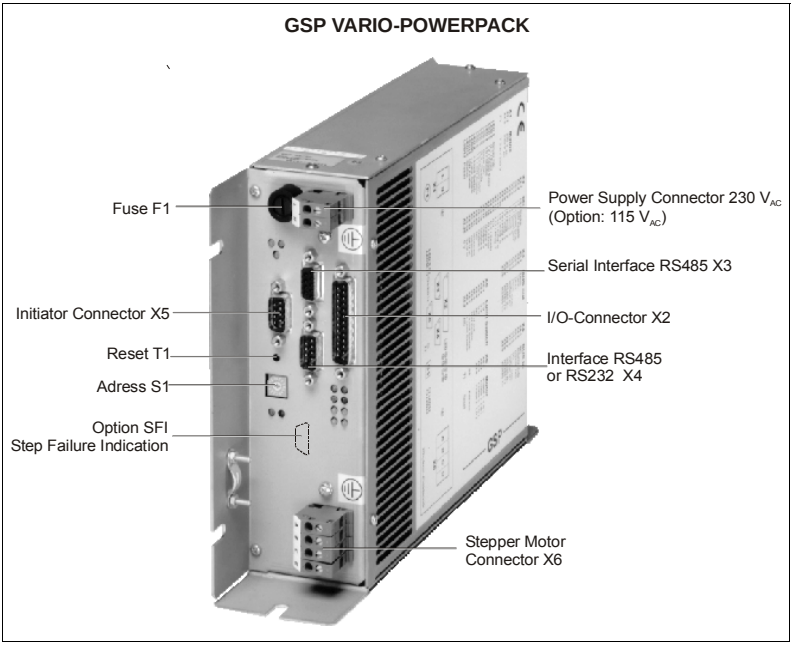


Fig. 1: Operational controls GSP VARIO

The GSP Vario Power Pack was designed for stepper motors to 9 A_{peak} phase current (70 V motor voltage). The GSP Maxi Power Pack is used for larger stepper motors up to 17 A_{peak} phase current (140 V motor voltage).

Both GSP are compact modules including axis controller, power stage and supply unit for direct connection to the mains 230 V_{AC} (GSP VARIO also for 115 V_{AC}).

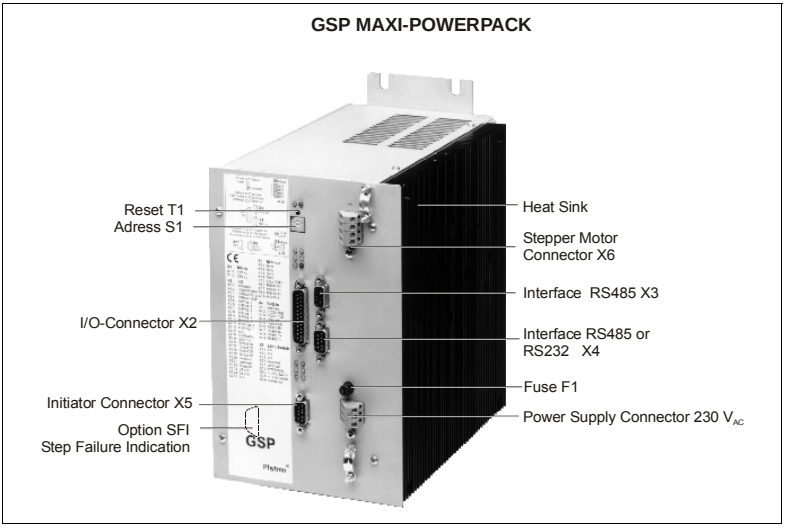


Fig. 2: Operational controls GSP MAXI

The power stage is directly controlled by a microcontroller, which receives motion commands from an overriding controller, for ex. a PC or a PLC. Therefore two operating modes are possible: ONLINE or PLC controlling

For connection to the overriding controller, the serial interface, RS232 or RS485, see chapter 9.1 can be used.

Ministep power stage for two phase stepper motors

The power stages of the GSP use Phytron's welltried technology, now with enhanced field synchronized current chopped regulation based on the patented SYNCHROCHOP principle developed by Phytron.

The step resolution is adapted to the number of revolutions dynamically. In case of low speed the GSP runs by 1/8 step, in case of high speed by full step.

Motor currents from 0.2 to 11.9 A_{eff}

Run current, stop current and boost current can individually be set in 16 steps of
0.2 A for GSP 52-70,
0.3 A for GSP 72-70,
0.4 A for GSP 92-70 or
0.8 A for GSP 172-140.

The maximum motor current is, depending on the GSP version
3.5 A_{eff} (5 A_{peak}) for GSP 52-70,
4.9 A_{eff} (7 A_{peak}) for GSP 72-70,
6.3 A_{eff} (9 A_{peak}) for GSP 92-70 or
11.9 A_{eff} (17 A_{peak}) for GSP 172-140.

AC power supply

Transformer, rectifier, load capacitor and mains supply are already included, therefore the unit can be supplied with 230 V_{AC} (for GSP VARIO optional 115 V_{AC}).
The power circuit is insulated from the process I/Os and all other inputs and outputs by optocouplers.

Auxiliary process supply voltage 24 V_{DC}

You need an auxiliary 24 V_{DC} power to supply the outputs, limit switches and the serial interface for the GSP VARIO.
For the GSP MAXI the external auxiliary voltage is necessary only to supply the outputs.

Inputs

The inputs are driven with 24 Volt level enabling a direct connection to PLC outputs.

Outputs

The outputs are driven by auxiliary power supply (24 V_{DC}). The outputs drivers are compatible to standard PLC inputs. The output drivers are short circuits protected. The auxiliary power supply must be switched off for the driver reset.

Limit switches

Two limit switches type PNP opener may be connected to the GSP. The limit switch power supply for GSP MAXI is generated internally. For the GSP VARIO these switches are supplied by the 24 V_{DC} auxiliary power. Of course, mechanical switches can be used as well.

Address switch

The logic axis address is set by the address switch. The address switch is variable from 0...9 and A...F. This rotary switch is only memorized during power on or after a reset, therefore later changes are ineffective.

Serial interface

The GSP is provided with the interfaces RS232 (3-wire point to point) for 1 GSP and RS485 (4-wire-bus) for more GSP, but only ***one*** of both interfaces is active.

To use the GSP VARIO serial interface, the auxiliary supply voltage 24 V_{DC} has to be applied.

Easy to mount and EMC compliant

The GSP has been designed for wall mounting.

The full metal housing is EMC compliant, a line filter for the supply voltage is already integrated.

Optional SFI module for step failure detection

1.2 Extent of Supply

Before testing the GSP device, please check the delivery for completeness.

The standard package consists of:

- GSP
- Manual GSP
- Manual IPCOMM Protocol
- Floppy disk set IPCOMM

Supplementary parts available are:

- 2 pieces #02002332, 9-pole connector for I/O (female)
- 1 piece #02000071, 9-pole connector for I/O (male)
- 1 piece #02002156, 25-pole connector for I/O (female)

For GSP with SFI the following supplementary is available:

- 2 pieces #02002332, 9-pole connector for I/O (female)
- 2 pieces #02000071, 9-pole connector for I/O (male)
- 1 piece #02002156, 25-pole connector for I/O (female)

1.3 GSP Schematic Diagram

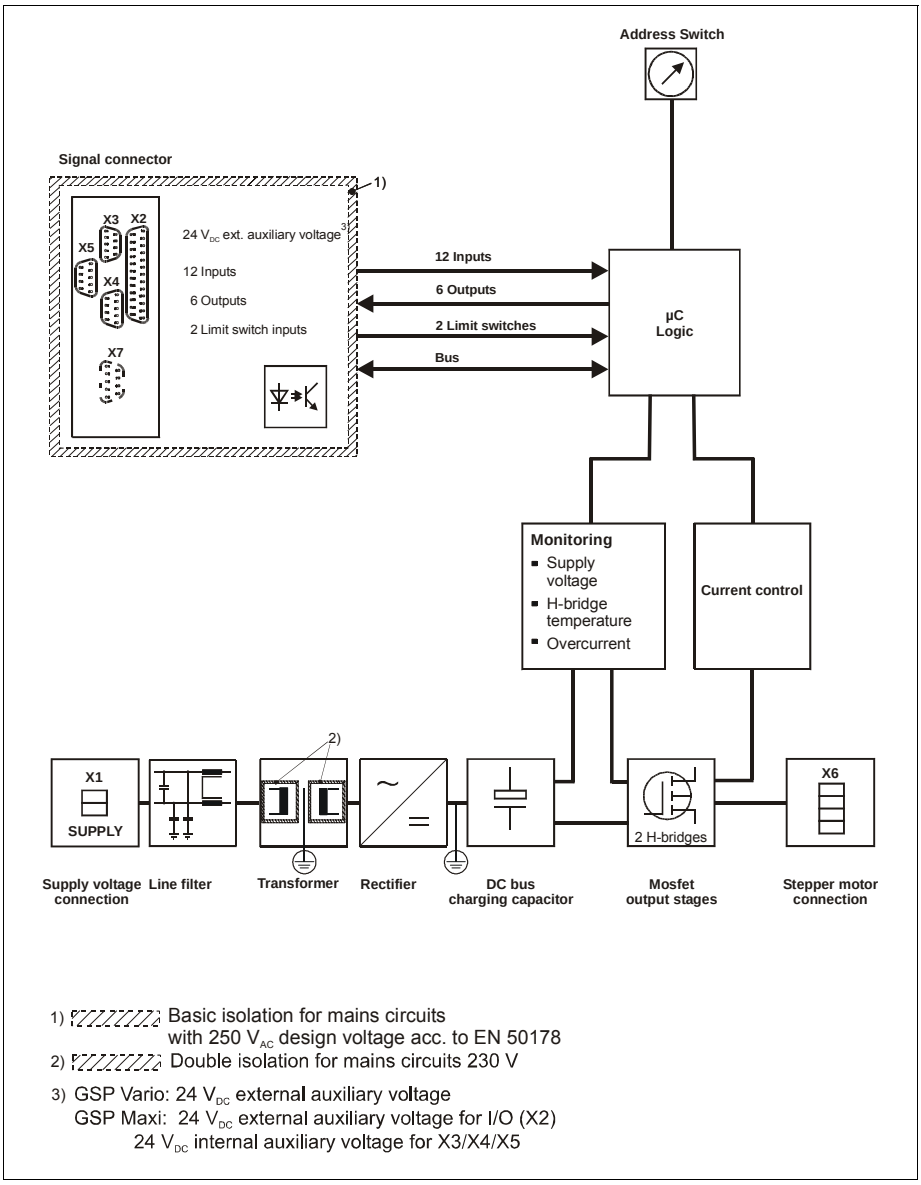


Fig. 3: Schematic diagram GSP VARIO and GSP MAXI

2 Technical Data Table

Technical Data	
Supply voltage [V_{AC}]	230 V_{AC} ±10 % 50-60 Hz (for GSP VARIO: Option 115 V_{AC})
	Fuse for GSP VARIO: T 2.5 A (230 V_{AC}), T 5 A (115 V_{AC}) for GSP MAXI: T 6.3 A
	Disturbance filter (EMI filter) integrated
Motor voltage	GSP VARIO: 70 V motor voltage GSP MAXI: 140 V motor voltage
Auxiliary process supply voltage	You need an auxiliary 24 V_{DC} power to supply the outputs, limit switches and the serial interface for the GSP VARIO. For the GSP MAXI the external auxiliary voltage is necessary only to supply the outputs.
Stepper motor	2-phase-stepper-motors with 4-, 6- or 8-lead wiring scheme Winding inductance per phase: min. 0.5 mH GSP VARIO up to 9 A_{Peak} phase current GSP MAXI up to 17 A_{Peak} phase current
Step resolution	The step resolution is adapted dynamically to the motor speed: Full step, Half step, 1/4 step, 1/8 step
Phase currents	Run current, stop current and boost current can be set by software in 16 increments. Programmable values: 0.2 to 6.3 A_{eff} (GSP VARIO) Programmable values: 0.8 to 11.9 A_{eff} (GSP MAXI) **Select phase currents fitting to the motor !** Factory setting: GSP 92-70: run current 1.6 A, stop current 0.8 A, Boost deactiv. GSP 72-70: run current 1.2 A, stop current 0.6 A, Boost deactiv. GSP 52-70: run current 0.8 A, stop current 0.4 A, Boost deactiv. GSP MAXI: run current 3.2 A, stop current 1.6 A, Boost deactiv.
Perm. motor cable length	Depending on the current setting and winding resistance, (chap. 5.2)
Motor cable cross section	Recommended 1 mm² for GSP VARIO and 2 mm² for GSP MAXI. Depending on peak current and cable length a smaller cross section may be acceptable. Refer to chapter 6 for details.
Mounting	Wall mounting
Minimum distances	Minimum horizontal distance to other devices: 30 mm Minimum vertical free over or under the GSP: 100 mm Required space for cabling and connectors: about 30 mm

Technical Data		
Perm. ambient temperatures	Operation: Storage: Transport:	0 to +40 °C –25 to +55 °C –25 to +70 °C
Ventilation	Operation without fan: Up to 40 °C ambient temperature with a phase current up to 4A GSP MAXI - with built-in fan - can be operated up to 50 °C ambient temperature with full current and 100% duty cycle.	
Weight	4.5 kg GSP VARIO 10 kg GSP MAXI	
Connectors	Signal I/O X2	25-pole D-SUB connector acc. to DIN 41652 (male)
	Bus connection X3	9-pole D-SUB connector acc. to DIN 41652 (female)
	Bus connection X4	9-pole D-SUB connector acc. to DIN 41652 (male)
	Initiator X5	9-pole D-SUB connector acc. to DIN 41652 (male)
	Optional SFI X7	9-pole D-SUB connector acc. to DIN 41652 (female)
Screw terminals	Motor	4-pole Print screw terminal plus PE-threaded terminal end
	Mains	2-pole Print screw terminal plus PE-threaded terminal end
Digital process inputs	The inputs are optocoupler-isolated. Input level: 24 V with common ground The current limiting resistor (2.2 kΩ) reduces the current to a nominal value of 10 mA at 24 V driving voltage. Signal level Low: Signal level High:	< 0.4 V 20 – 30 V
Digital process outputs	The outputs are optocoupler-isolated. The outputs use a standard source driver chip type UDN 2987. The outputs are protected against over-current and over-temperature. Nominal driver current is maximum 50 mA.	

3 To Consider Before Installation

Read this manual very carefully before installing and operating the GSP.
Observe the safety instructions in the following chapter!

3.1 Qualified Personnel

Design, installation and operation of systems using the GSP may only be performed by qualified and trained personnel.

These persons should be able to recognize and handle risks emerging from electrical, mechanical or electronic system parts.

WARNING !

By persons without the proper training and qualification damages to devices and persons might result!

3.2 Safety Instructions

1. The GSP must only be operated if GSP housing and motor housing are connected to protective earth.
2. The PE leads of mains X1 and motor connection X6 should be fixed to the housing with the earthing screws.
3. The mains cable should be fixed with the cable clamp for pull relief.
4. The motor cable shielding mesh has to be conductively connected to the GSP housing. Therefore remove the outside cable sheath in the range of the cable clamp.

5. If you need to open the GSP device:
   Up to 3 minutes after turning off the supply voltage, dangerous voltages may still exist within the device.
6. **Be careful handling the screw terminals „Motor“ X6 at the GSP and any motor cable coupling.**
   As long as the GSP is connected to supply voltage, a hazardous voltage level is present at motor connector and motor cable, even if the motor is not wired.
7. **Up to 3 minutes after turning off the supply voltage, dangerous voltages may still exist at the GSP connectors.**

8. Do always switch off the supply voltage if you connect or disconnect any wires or connectors at the GSP.
   Most important:
   Do not disconnect the motor while powered.
   Danger of electric arcing.

9. The digital inputs and outputs connected to X2, X3, X4, X5 and X7 should be safely separated from mains. The maximum voltage against protective earth must not exceed 25 V_{AC}.

10. To switch off the drive safely, the voltage supply has to be safely switched off (by relay contact, for example).

11. The surface of the GSP may reach temperatures of more than 70 °C.
    Danger of injury if touching the surface!

4 Mounting

- The GSP should be vertically mounted.
- Mount the GSP at a plane surface with appropriate load capacity (device weight is about 4.5 or 10 kg).
- Recommended free space below and above the device: 100 mm. Keep the air slots free to allow a convective air exchange!
- Recommended free space to other devices besides the GSP: 30 mm
- Recommended free space for cables and connectors before the front side of the GSP MAXI or under the GSP VARIO: 30 mm
- The GSP has to be mounted and operated at a place free of shocks and vibrations.

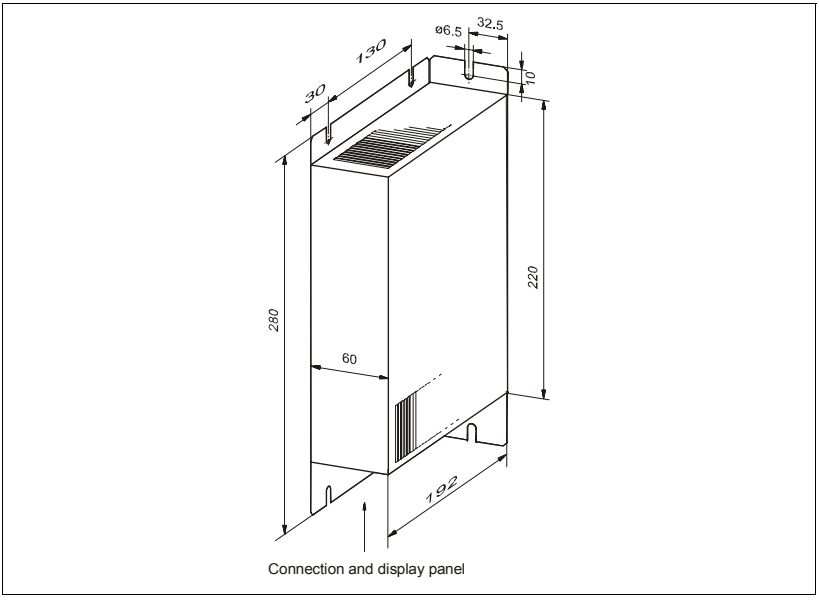


Fig. 4: Dimensions and preferred mounting position of the GSP VARIO (mm)

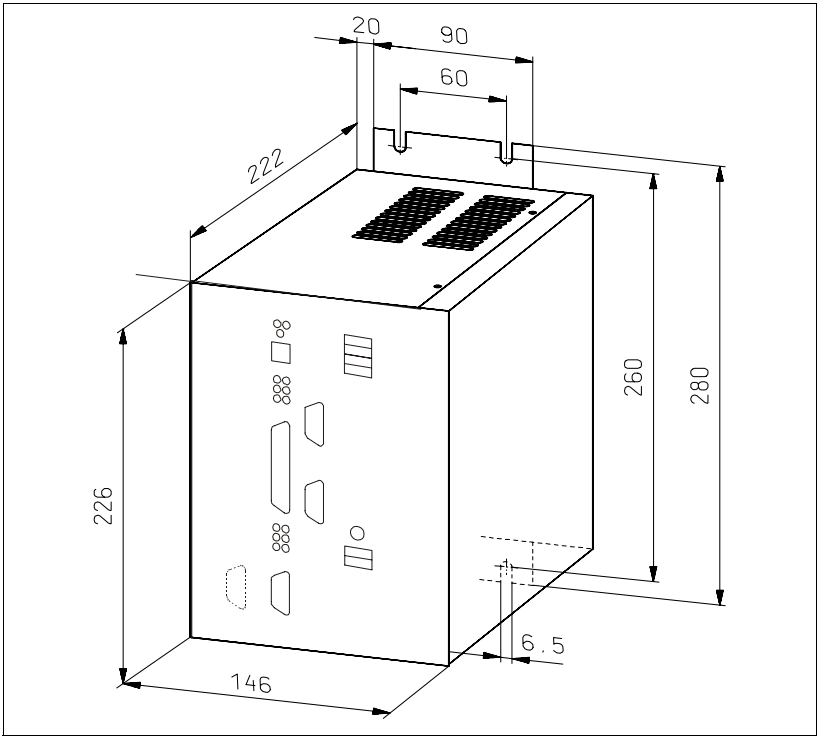


Fig. 5: Dimensions GSP MAXI (mm)

4.1 Ventilation

The heat production in the GSP depends on the motor current setting. The thermal power at maximum current in the GSP VARIO is 45 W and in the GSP MAXI 90 W.

Mounting instructions

When mounting the GSP in an electric cabinet correct air circulation should be cared for. Fig. 3 shows the preferred mounting position. Vertical mounting provides better ventilation.

A fan is mounted in the GSP MAXI. Besides, an optimum transport of the thermal power is reached with the heat sink.

5 Supply Voltage

The following chapters give information about the power supply of the GSP and the current setting. The supply voltage has to be wired to the screw terminals X1.

The current supply directly comes from the alternating current mains. The power circuit is electrically insulated from all inputs and outputs.

To operate the GSP VARIO an external auxiliary voltage 24 V_{DC} is required.

5.1 Screw Terminals Connection X1

Please check your device by the type plate, if it is acceptable for the local mains !

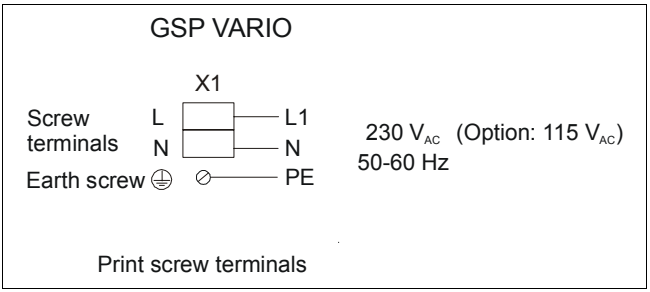


Fig. 6: Mains connection GSP VARIO

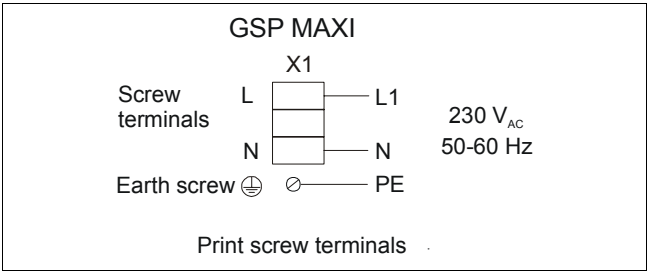


Fig. 7: Mains connection GSP MAXI

5.2 Current Setting

Run current, stop current and boost current can be set individually in 16 increments.

Set the currents fitting to the motor winding! Refer to motor data sheet !

Power stage	GSP 92-70	GSP 72-70	GSP52-70	GSP 172-140
Increment	Current A_{eff}	Current A_{eff}	Current A_{eff}	Current A_{eff}
0	0	0	0	0
1	0.4	0.3	0.2	0.7
2	0.8	0.6	0.4	1.5
3	1.2	0.9	0.6	2.2
4	1.5	1.2	0.8	2.9
5	2.0	1.6	1.1	3.7
6	2.4	1.9	1.3	4.5
7	2.8	2.2	1.6	5.3
8	3.3	2.6	1.8	6.1
9	3.8	3.1	2.1	7.1
10	4.2	3.3	2.3	8.0
11	4.6	3.6	2.6	8.7
12	5.1	4.0	2.8	9.6
13	5.5	4.3	3.1	10.4
14	5.9	4.6	3.3	11.2
15	6.3	4.9	3.5	11.9

Factory settings of the GSP:

	GSP 92-70	GSP 72-70	GSP 52-70	GSP MAXI
Run current	1.5	1.2	0.8	2.9
Stop current	0.8	0.6	0.4	1.5
Boost current	deactivated (boost current = run current)			

The **maximum current consumption** depends on the supply voltage, the phase current selected and the ohmic resistance of motor winding and motor cable.

The mean current value at the terminals X1, evaluated over a period of 30 sec, must not exceed 2.5 A.

6 Motor Connection

The following chapter gives a description of how to wire different types of 2-phase stepper motors. GSP stepper motor controllers can be connected to stepper motors with 0.2 to 11.9 A r.m.s. phase current.

The stepper motor winding resistance should be less than 10 Ohm for full power.

The winding inductivity of one phase should be in the range of 0.5 to 10 mH.

Stepper motors with 8 leads, can be connected with the windings wired in parallel (1) or serial (2).

For the 6-lead stepper motors, wiring scheme (3) with serial windings is recommended. If wiring scheme (3) cannot be used because of the motor construction, the motor may be operated with only two of the four windings energized according to wiring scheme (4). In this case the ohmic losses are higher, so the motor will deliver only about 70% of the nominal power due to thermal limitations.

Warning:

5-lead stepper motors must **not** be connected to the GSP.

6.1 Motor Screw Terminals X6

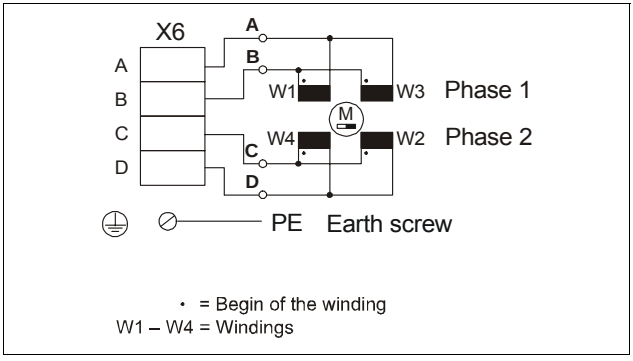


Fig. 8: Motor connection GSP

Important!

When connecting the shielded motor cables to the screw terminals, the contact resistance must be as low as possible.

We recommend to use cables with crimp terminals according to DIN EN 50 027.

6.2 Wiring Schemes

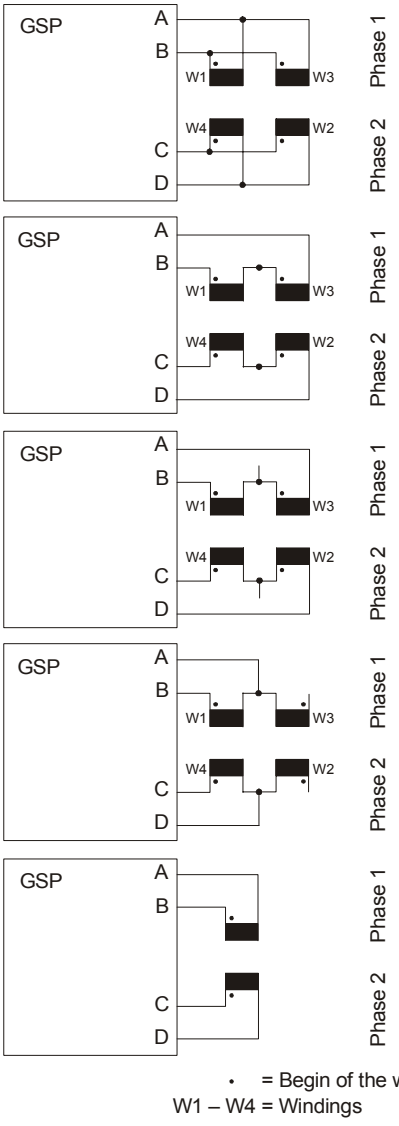


Fig. 9: Connection diagrams for 4-, 6- and 8-wire stepper motors

6.3 Motor Cable

We recommend to wire the stepper motor with a 5-lead cable with shielding mesh. For optimum electromagnetic compatibility (EMC), the cable should not be interrupted by additional connectors or screw terminals.

The following cable cross section should be chosen for the motor cables with maximum current:

Positioning module	**Cable cross section**
GSP 52-70	0.5 mm^2
GSP 72-70	1.0 mm^2
GSP 92-70	1.0 mm^2
GSP 172-140	2 mm^2

Acceptable motor cable length: depending on current setting and motor resistance (chap.5.2).

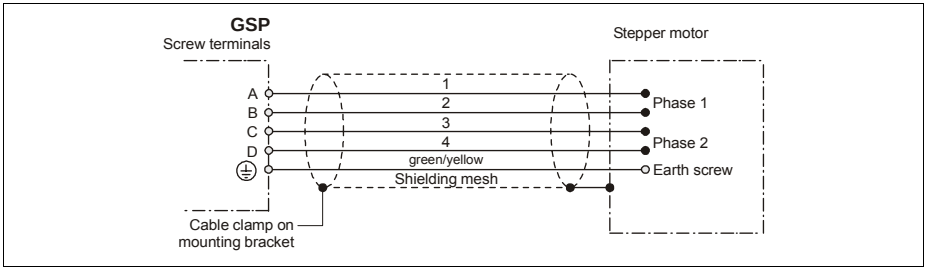


Fig. 10: Cable connection GSP – motor

The protective earth wire (green/yellow) of the motor cable should be connected to the earth screw near the GSP motor terminals. At the other motor cable end, the green/yellow wire should be connected to the motor's earth screw.

For best electromagnetic compatibility (EMC), you should connect the shielding mesh to the GSP housing. Use the cable clamps at the front side.

The shielding mesh should be also connected on a large surface to the motor housing. Use EMC-type conduit fittings. All parts of the motor should be conductingial shield clamps. At the motor side we recommend to use special conduit fittings. With very small motors, it may be enough to connect the cable shield with the metal parts of the machine nearby the motor.

Warning:
Motor leads not used shall be insulated carefully (important if using wiring scheme 3 or 4)!

7 Inputs and Outputs

The I/O connector X2 is used to wire digital process control signals. The connectors X3 and X4 are bus connections for the serial interfaces RS232 and RS485. But only one of both interfaces can be active. X3 is used as output and X4 as an input. X3 is only active, if RS485 is connected to X4.

The limit switches are connected to X5 and connector X7 (Option) is used to wire an encoder.

7.1 Interfaces

Important:

You need an auxiliary 24 V_{DC} power to supply the outputs, limit switches and the serial interface for the GSP VARIO.
For the GSP MAXI the external auxiliary voltage is necessary only to supply the outputs.

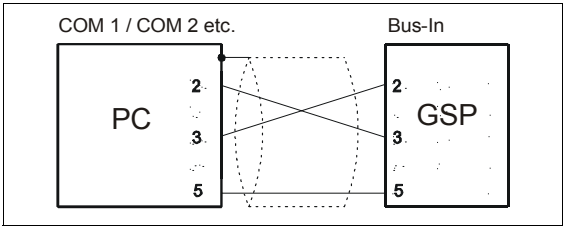


Fig. 11: Cable RS 232

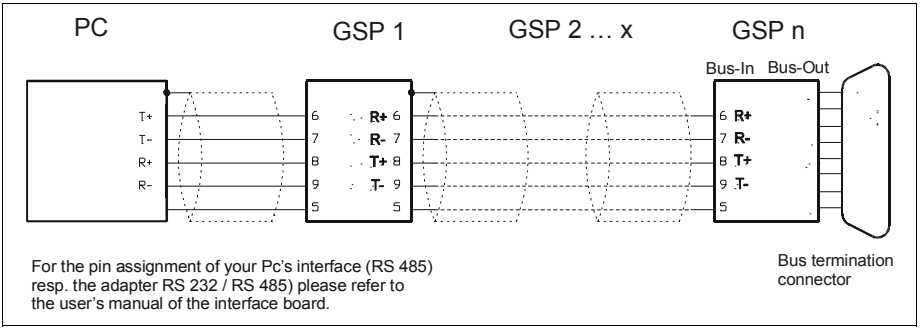


Fig. 12: Cable RS 485

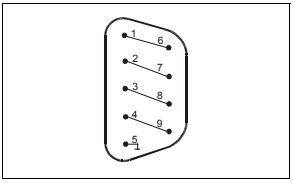
If operating more than one GSP device (max. 16) at one serial interface of your master controller, the RS 485 field bus is best choice. (bus connection, 4 wire operation). For each GSP device please select unique axis IDs (addresses) by the address switch. The axis-ID is used for application and programming the GSP.

At the distant end of the RS 485 bus please use the integrated bus termination resistor network at the very last GSP in the chain. Each GSP contains bus terminator resistors (120 Ω), and by applying a dummy D-SUB connector with 4 little bridges in it these termination resistors are switched onto the bus (Fig. 12).

Important:

Commercial RS 485 boards for PC are set to 2 wire connection. The GSP transmission protocol is based on 4 wire operation. Therefore, the RS 485 board should be reprogrammed, or we recommend to use a RS 422 board which enables 4 wire operation.

The bus termination connector is connected to the pin BUS-OUT (X3).



Attention:

The bus connectors PIN 2 and 3 must not be connected!

For RS 232 no bus termination connector is necessary!

Fig. 13: Bus termination connector RS 485

7.2 I/O Connector X2

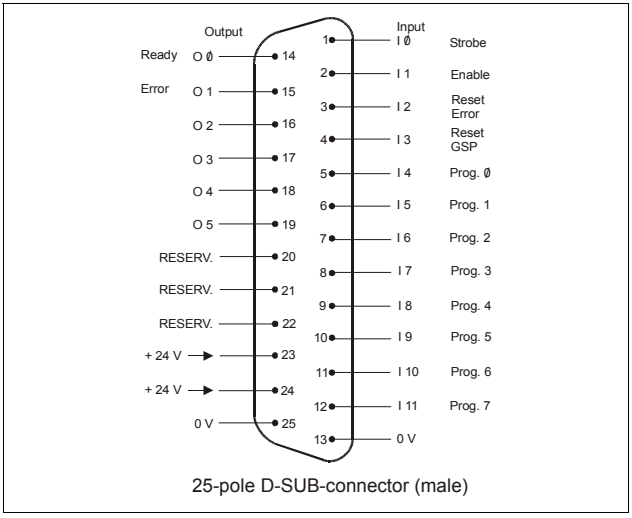


Fig. 14: I/O connector X2

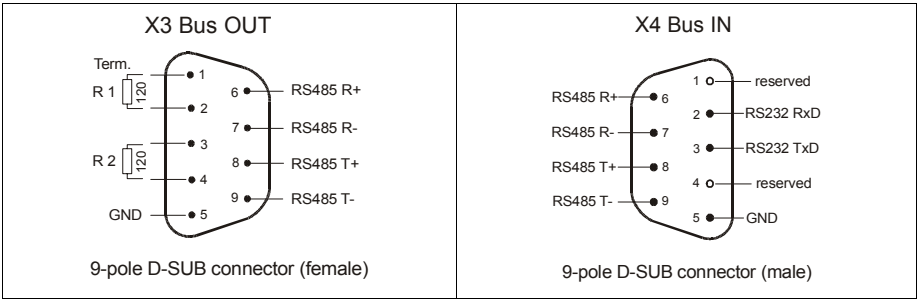


Fig. 15: Bus connection for serial interface

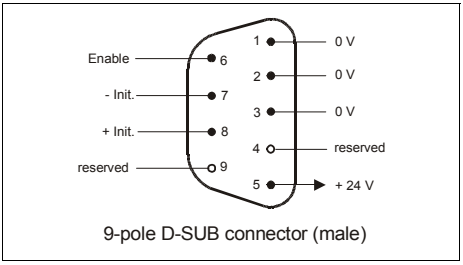


Fig. 16: Limit switch connector X5

Attention:

- **Do not exchange X4 with X5 by mistake! Danger of damage to the GSP.**

Connector X7 (**S**tep **F**ailure **I**ndication SFI) see chapter 9.5

7.3 Digital Inputs

All digital inputs are optically insulated from the GSP supply voltage. This assures best noise suppression between control and power circuit. The cathode pins of the opto-couplers are connected to GND (of 24 V_{DC}). The nominal input level is 24 V.

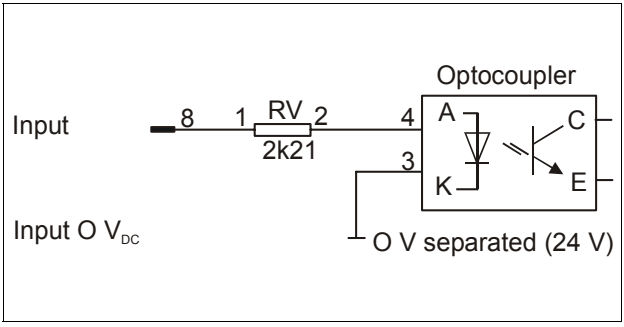


Fig. 17: Digital I/O input circuit, schematically

7.4 Digital Outputs

All output drivers are optically insulated from the GSP supply voltage. The outputs use a driver chip type UDN 2987. Each channel is protected against over-current and over-temperature. The rated output current is I_{max} = 50 mA.

All digital outputs are connected with GND of the 24 V_{DC} auxiliary voltage.

In case of a fault condition the output driver will be locked to the off state. To reset an over-temperature or over-current error, the auxiliary voltage (24 V) has to be switched off and on again.

7.5 Address Switch

The logical axis address is fixed by the address switch. The rotary switch is variable from 0...9 to A...F. This switch setting is only read after power on or Reset, that means that later changes are ineffective.

Also for RS 232 (point-to-point connection), a significant address has to be used!

7.6 Limit Switch Connector X5

Type PNP-opening limit switches (initiators) can be connected to the GSP. The advantage is that parting of a cable can be recognized.

For GSP VARIO the auxiliary voltage +24 V_{DC} has to be supplied to the connector X2. The limit switches will receive maximum 150 mA of it (short circuit-proof) at connector X5.

For GSP MAXI the power supply for the limit switches connectors will be generated internally.

Not used limit switch inputs have to be referred to 24 V with a wire strap.

HW Enable

Only if the enable input HARDWARE (HW) ENABLE (X5) is active, the motor will run. Pin 6 at the connector X5 has to be connected with +24V_{DC} (for example gate contact). The input is active at all mode of operations.

SW Enable

Input I1 of the connector X2 is used as enable input SOFTWARE (SW) ENABLE in the PLC mode. Only if the input is active, the motor will run.

If the input becomes inactive, a controlled stop will be done:

- The movement stops, the motor will be braked with the programmed ramp.
- The position counter is valid.

8 Basics of the GSP Functions

This chapter describes the GSP functions and how to adapt the control parameters to a wide range of applications.

8.1 Control Software Structure

The GSP software consists of two modules called BIOS and SYSTEM, stored in a flash EPROM. The software can be reloaded via PC without opening the device. Please find detailed information in the appendix of the separate IPCOMM manual.

8.2 Control Parameters

In the following chapter you'll find an overview. In chapters 9.1 and 9.2 is described how to change the parameters.

At delivery, all GSP control parameters are set to the BIOS-Default settings.

In the GSP there are three copies of this parameter list: a table in the program memory (BIOS-Default), a table in the permanent data memory and a table in the working memory. After power on or reset, the data of the permanent memory will be copied into the working memory.

During operation, parameter changes are only valid for the working memory in the RAM. Changes can be made non-volatile by saving the parameters, for example by means of IPCOMM.

Parameter	Unit	Default Value	Range
Start/stop frequency	Hz	400	1 .. 1,250
Run frequency	Hz	2,000	1 .. 10,000
Acceleration ramp	Hz/s	5,000	1,700 .. 16,4000
Emergency stop ramp	Factor	0	0 .. 255
Stop current	A	Step 2	0 .. 6.3
Run current	A	Step 4	0.1 .. 6.3
Boost current	A	0	0 .. 6.3
Recovery time	ms	20	0 .. 4,000
Axis limit	1/8-Step	1,000,000	0 .. $2*10^9$
Offset to +limit switch	1/8-Step	0	0 .. $2*10^9$
Offset to –limit switch	1/8-Step	0	0 .. $2*10^9$
Play compensation	1/8-Step	0	$-2*10^9$ .. $2*10^9$

Parameter	Unit	Default Value	Range
Axis type (linear/rotational)	-	0	0 / 1
PLC mode	-	0	0 / 1
Baud rate	Bit/s	28,800	9,600 / 28,800

9 Turning a GSP into Operation

The GSP has two basic operation modes: The *online mode* and the *PLC mode* (see chap. 9.1 and 9.2).

After the first power on the GSP will start up in the *online mode*.
If the GSP is configured with IPCOMM for the first time, after reset the *PLC mode* is active. At first configuration, PLC sequences are to be defined, *PLC mode* to be set and parameters to be stored.

For turning a GSP into operation the following preparations are necessary:

- Connect the stepper motor to the GSP stepper motor terminals
- Connect the power supply 230 V_{AC} (Option 115 V_{AC} for GSP VARIO) to the mains terminals
- Connect the limit switches to the GSP, or install bridges of 24 V to the limit switch inputs
- For testing on a PLC: Connect the digital inputs and outputs (at least STROBE and READY)
- Connect the serial interface BUS IN to a PC (via 9pole RS232 D-Sub connector)
- Set the axis ID of the GSP (rotary switch under the bus connection)

  Remark: For the data exchange, there is no difference between RS 232- and RS 485 connection, that means that the protocol is already similar (see IPCOMM manual). That means concretely that the position of the address switch “axis ID” must be set for using IPCOMM.

After power on the GSP starts with a self-test.

After the start of the communication software IPCOMM on your PC, you have to set the following items in the IPCOMM:

- Selection of the serial interface (in the menu item ***Interface***).

  Remark: If you select "**None**" as setting for the communications ports, IPCOMM will not try to access the GSP.

- Selection of an axis mouse click onto the button axis ID in the field ***axis*** (Fig. 17)
- You can open the axis window either with (Fig. 18) ***Communication*** via the main menu or directly
- by clicking onto the button with the axis' number.
- By clicking onto the button ***Status*** a status inquiry is sent to the GSP. If the communication with the GSP is not correct, a warning will be given. In this case please check the cabling, the I/O connector allocation to the serial interfaces and also the interrupt setting on the I/O-board.

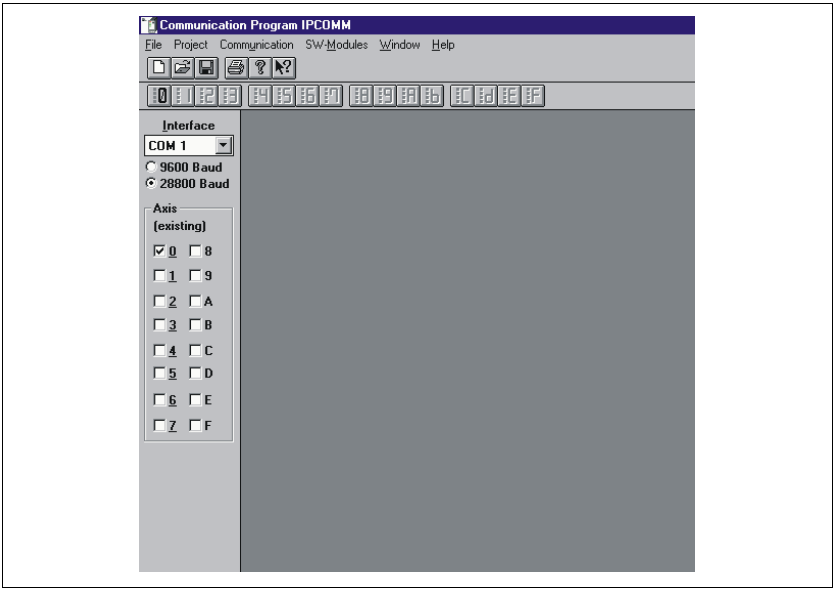


Fig. 18: Window for selection of interface and axis

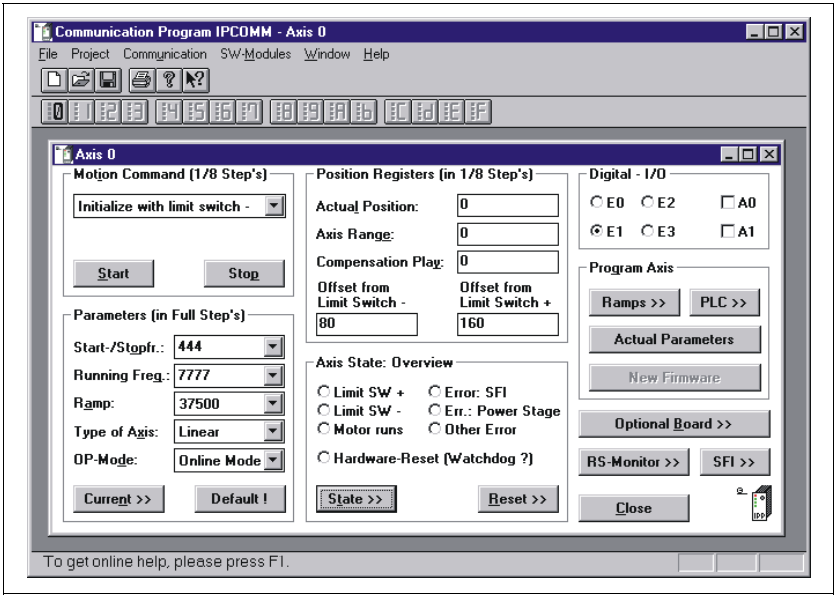


Fig. 19: Main axis window with edit field for the motion parameters

In the *Online Mode* the GSP receives commands from a master computer (PC) via serial interface. The software protocol is delivered with each GSP, also the configuration software IPCOMM. With the help of this software the main controlling parameters can also be changed. You can select simple motion commands to test the axis dynamic. With IPCOMM you can program PLC motion commands in the non volatile GSP memory. You can also test these commands.
In the *Online Mode* all outputs are free for the customer.

In the *PLC Mode* the GSP can be controlled by setting the digital inputs. In the *Online Mode* the PLC sequences which are set by the IPCOMM will be executed.
The output READY is only active in the *PLC Mode*.

9.1 GSP in the Online Mode

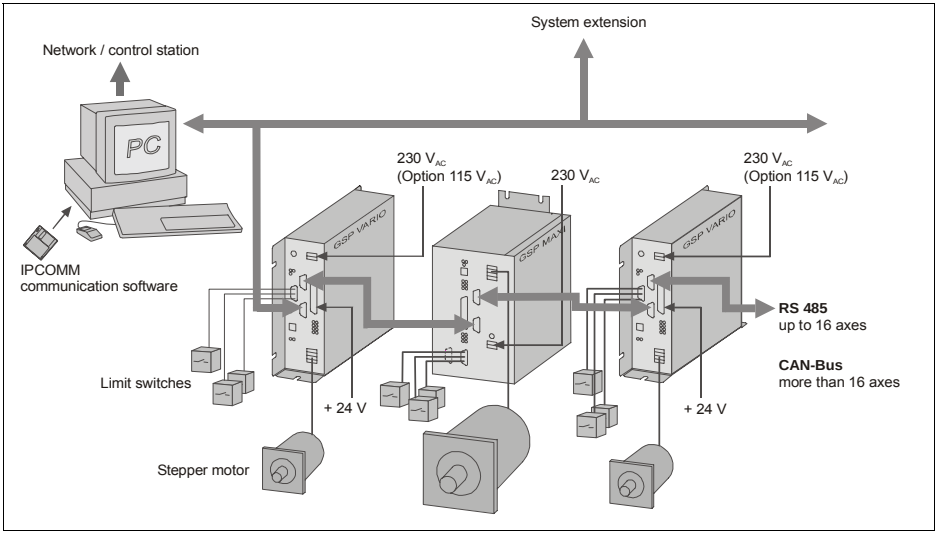


Fig. 20: GSP for complex handling operations

In the *Online Mode,* the GSP receives commands via serial interface from by a master computer (PC, PLC, overriding controller).

Data are exchanged by telegrams which should meet a rigid protocol. This "IPCOMM protocol" is explained in the manual MA 1086 delivered with each GSP.

9.2 GSP in the *PLC Mode*

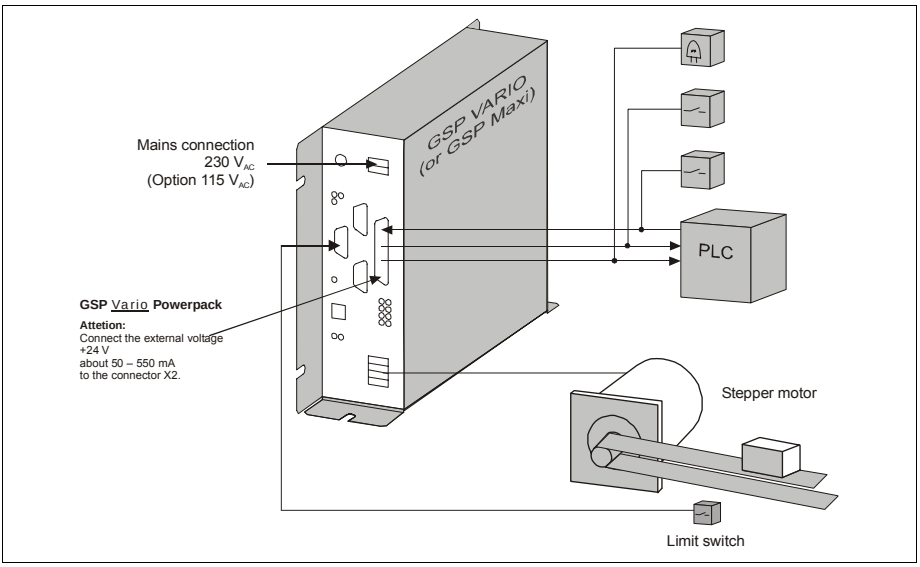


Fig. 21: GSP in the PLC mode

The *PLC mode* (PD1) means: the GSP receives commands from a master controller via the digital inputs. In this operating mode the handshake with the master controller is performed via the digital outputs.

In order to ensure safe data exchange, a defined protocol has to be observed. The PLC has to wait for the GSP's READY signal. After that the PLC can prepare the program information which is subsequently activated by a STROBE signal. The GSP receives the program information and processes the command. During program execution READY becomes passive.

In the *PLC mode* the **digital inputs** have the following meanings:

STROBE: Activates the selected motion command.

SW-ENABLE: Releases the axis. **Without this signal the axis cannot be started.**

By deactivation SW-ENABLE each positioning can be interrupted. The motor is stopped and decelerates with ramp. The positioning counter contains a valid value.

HW-ENABLE: must always be energized with 24 V. The signal HW Enable is the connection between the logic and the power part of the GSP (Fig. 21). (Also see page 25)

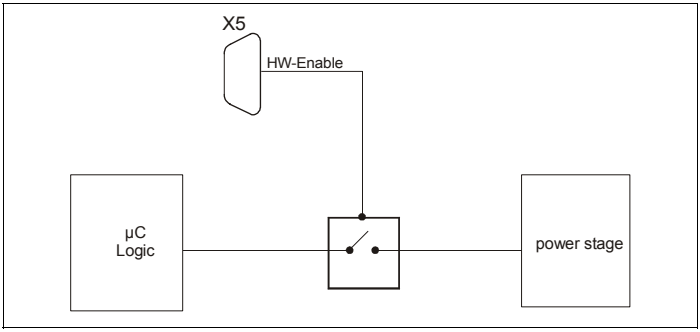


Fig. 22: Input HW Enable

Prog x: With the eight program selection inputs, one out of 256 motion commands can be selected out of the PLC table. The input bits are interpreted binary. These inputs should be stable before the STROBE signal is triggered. We recommend to wait at least one idle cycle of the PLC.

The meaning of the **digital outputs** in the PLC mode is:

Output 0 READY
The GSP is ready to accept the next motion command. At motor start, this signal is set to zero. It is switched on again only after the motor stands still AND the STROBE signal is no longer active AND the recovery time T_{DELAY} has elapsed.

Output 1 ERROR
There is an error condition which might have one of the following reasons:
- Selected motion command has not been programmed.
- Limit switch error
- Power stage error

Inputs: Reset Error: resets the error output in the *PLC Mode* (Delete function)

Reset GSP causes the GSP HW-Reset

The inputs have priority of the program inputs and will be activated by STROBE.

To ensure a well defined communication between PLC and GSP - independent on the contact bounces etc. – you have to use a sequential protocol:

1. The PLC has to wait until the GSP shows the **READY** signal.
2. In the next step the PLC has to set up the program information **PROG 0** to **PROG n**.
3. The following **STROBE** tells the GSP to evaluate the program information and to execute the corresponding command. **Remark: PROG 0 .. PROG n** and **STROBE** should not be set in the same PLC cycle. Make sure that the program outputs have switched, when **STROBE** is activated.
4. The GSP reads the program information and starts the motion command. As a handshake signal the GSP will set **READY** to 0 at this time.
5. With finishing the command, **READY** becomes again active to show that a new command can be sent. Eventual the error signal **ERROR** is set before, if
   - the power stage generated an error signal (over-temperature, mains supply fault or over-current).
   - the PLC started a program which is not defined within the GSP.

Remarks:

- **READY** will become active only if the PLC has reset the **STROBE** signal.
- The **STROBE** signal may be reset after the **READY** signal has disappeared. The motion command will be executed independent of the STROBE signal except for special command “free run”. “Free run“ will be executed as long as the **STROBE** signal is high, the motion will stop immediately when **STROBE** goes back to 0.

The digital data exchange between PLC and GSP is shown in the following figure:

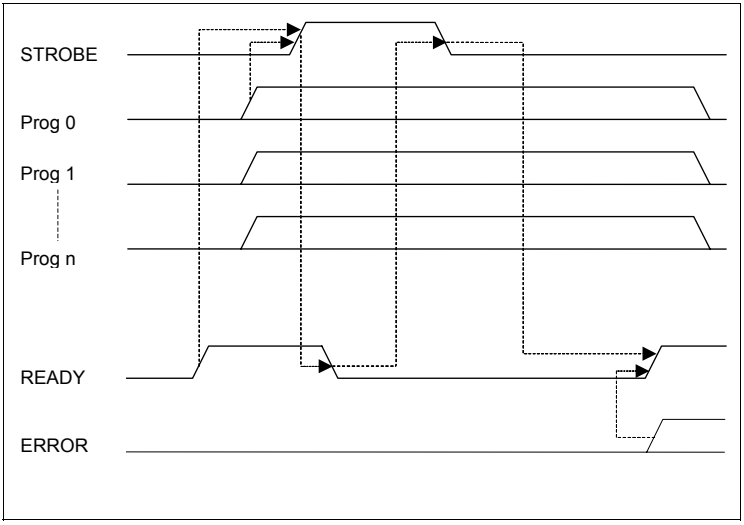


Fig. 23: Digital handshake protocol

Remark:
The inputs SW ENABLE and HW ENABLE always must be high, as long as the motor should run!

9.3 Trouble-Shooting

The following list might help you to repair failures.

Problem: Error message over-temperature

Check ventilation (chapter 4.1) and current setting (chapter 5.2).

Problem: Motor does not run.

Check the current settings. At delivery run current and stop current are set to the following values:

	GSP 92-70	GSP 72-70	GSP 52-70	GSP MAXI
Run current	1.5	1.2	0.8	2.9
Stop current	0.8	0.6	0.4	1.5
Boost current	deactivated (boost current = run current)			

Check the motor wiring (chap. 6).

Problem: The stepper motor is inadmissibly hot.

Check the current settings.

For Boost current and run current settings please refer to the motor label or data sheet.

We recommend to set the stop current to 50% of the run current .

Problem: Troubles and/or error messages in spite of correct wiring

Eventually, EMC problems exist. Only use shielded motor cables. Connect the protective conductors with the earth screws near by the screw terminals X1 and X6. Also refer to chap. 6.1 and 6.3.

Problem: Troubles during operation with the RS485 interface

With RS485, normally no GSP is set to send. The controller only anwers for commands , if it is addressed. That means normally the conductor to the PC is tristate, so the level is not defined. Then, troubles on the receiver side (PC) may emerge, when the receiving level is drifting.

We recommend as help to wire a resistor(e.g. 475 kΩ) from R+ to VCC and from R– to GND.

Important: A bus termination resistor acc. to RS485 standard
(120 Ω between R+ and R–) has to be wired in each case.

9.4 LED Displays

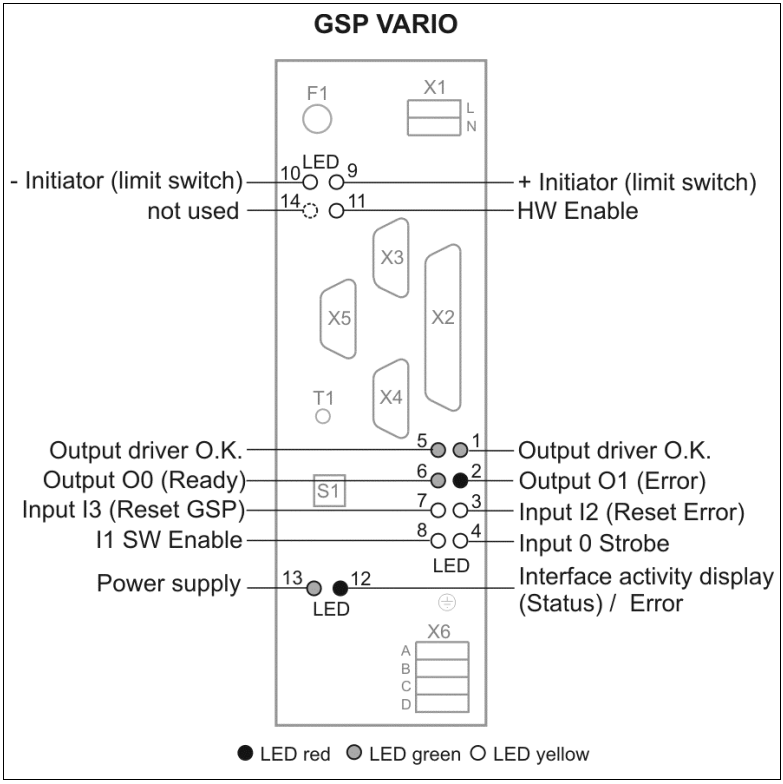


Fig. 24: LED field GSP VARIO

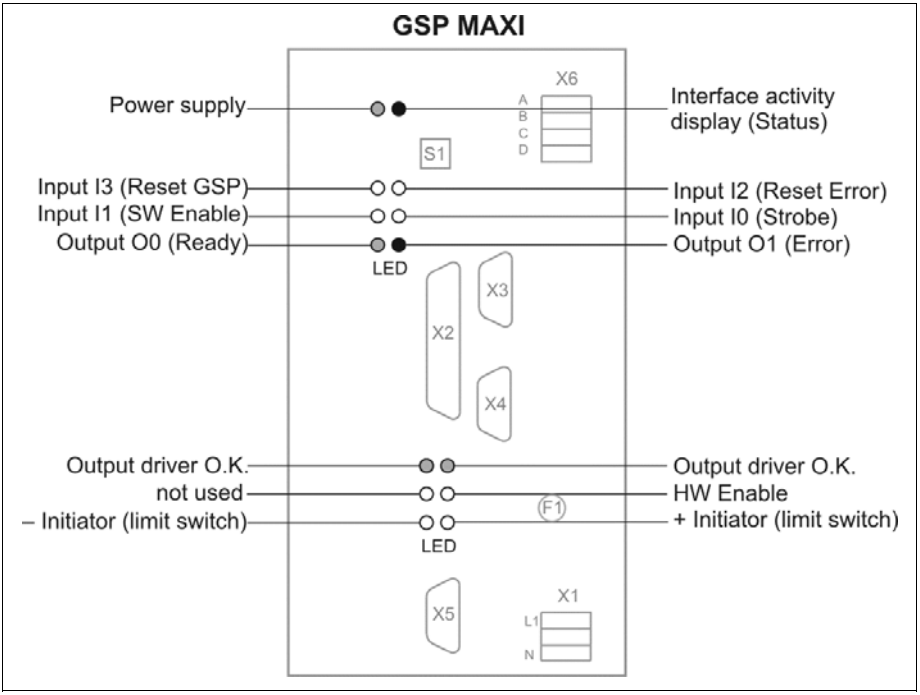


Fig. 25: LED field GSP MAXI

Remark:

The output driver is used to switch the 24 V outputs and the limit switch voltage.

In case of short circuit or overloading or missing of the auxiliary voltage +24 V both LEDs „Output driver O.K.“ don’ t shine (eventual one LED shines).

9.5 SFI Module (Option)

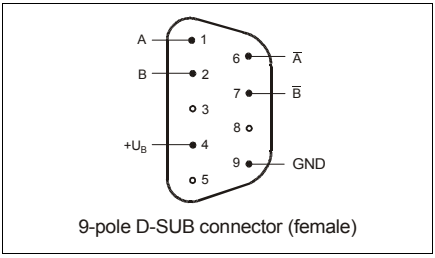


Fig. 26: Option Step failure indication SFI X7

With the optional SFI module (Step Failure Indication) you can permanently monitor a stepper motor with encoder. So faulty motor positioning in case of overload can be rapidly detected.

The SFI circuit compares the set value (arriving pulse signals) with the true value (stepper motor position). The signal variation must not exceed seven full steps, otherwise an error signal is generated. The GSP will react on the error signal and stop the motor.

The incremental encoder supply voltage is generated by the SFI module:

approx. 5 V / 100 mA max.

Suitable incremental encoder resolutions: 50 / 200 / 500 / 1000.

A differential encoder with two output signals shifted by 90° can be wired to connector X7.

The SFI module's signal inputs are optically insulated. High noise immunity is obtained when driving the signal inputs with RS422 control signals.

The SFI module is programmed via IPCOMM.

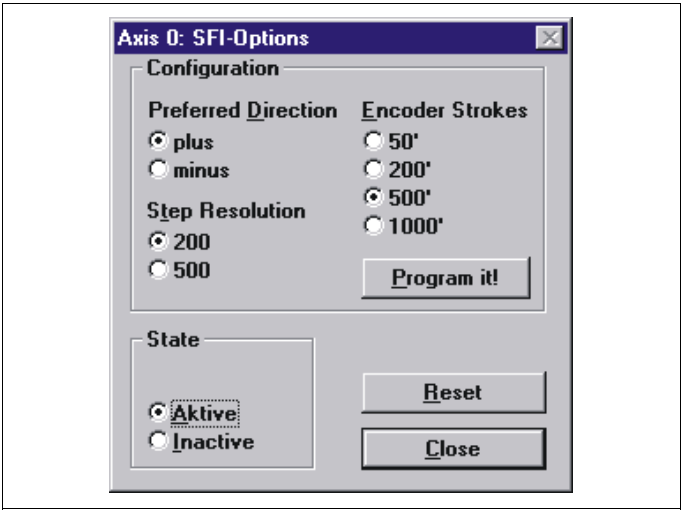


Fig. 27: SFI programming via IPCOMM

The following reasons for a reaction of the SFI are possible:

- High resonance disturbing (especially in the lower revolution range)
- Pulling out of synchronism of the motor during accelerating or braking
- To large load moment
- Wrong motor current setting
- No or wrong connected motor
- No or wrong connected incremental encoder
- Wrong setting of incremental transducer resolution
- Wrong setting of motor step number
- Wrong setting of preferred direction
- Unshielded, long cables
- Disturbances on the input signals

9.6 CE - Sign

GSP VARIO and MAXI POWERPACKS are certified according to the applicable European Standards and may bear the CE mark.

GSP POWERPACKs comply with EMC standards, such as EN 50081-1,-2 and 50082-1,-2.

These standards allow the use of GSP POWERPACKs in residential and industrial environments. The unit includes all necessary filtering equipment.

Insulation dimensioning; according to VDE 0160. Certificate of conformity on request.

9.7 Warranty

The GSP devices are subject to Phytron's legal warranty after delivery. Phytron will repair or exchange devices which show a failure due to defects in material or caused by the production process. This warranty does not include damages. which are caused by the customer, as there are, for example, not intended use, unauthorized modifications, wrong treatment or wrong wiring.

9.8 ESD Protection Measures

All the products which we deliver have been carefully checked and submitted to a longterm test. To avoid the failure of components sensitive to electrostatic discharge (ESD), we apply a great number of protective measures during manufacturing, from the component input check until the delivery of the finished products.

Warning:

Manipulation of ESD sensitive devices must be effected by respecting special protective measures (EN 61340–5). Only return the modules or boards in adapted packaging.

Phytron's warranty is cancelled in case of damages arising from improper manipulation or transportation of ESD modules and components.

10 Index

Phytron-Elektronik GmbH • Industriestraße 12 • 82194 Gröbenzell, Germany
Tel. +49(0)8142/503-0 • Fax +49(0)8142/503-190 • E-Mail info@phytron.de • www.phytron.de

Phytron, Inc. • 600 Blair Park Road Suite 220 • Williston, VT 05495 USA
Tel. +1-802-872-1600 • Fax +1-802-872-0311 • Email info@phytron.com • www.phytron.com