

GSI Lumonics

HelperCard

PC Hardware Controller

Reference Manual

**60 Fordham Road
Wilmington, MA 01887**

**GMAX™ SYSTEMS
MULTI-AXIS BEAM HANDLING**

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HelperCard

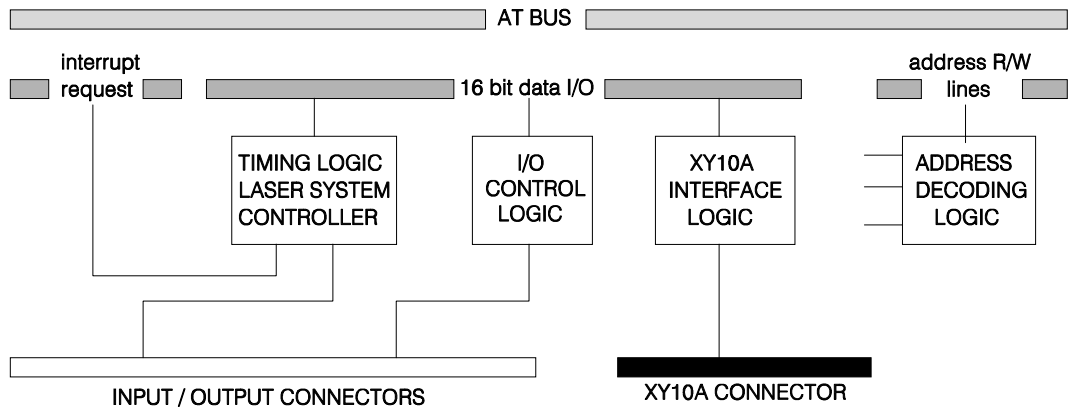
1. INTRODUCTION

The purpose of the **HelperCard** is to provide a hardware link between an IBM-AT compatible and a GSI Lumonics marker output system. It is fully compatible with the software **PC-MARK**.

The **HelperCard** has the following functional blocks:

- a) Interface to 16 bit PC bus.
- b) Interface to I/O connectors.
- c) Shutter control circuitry (currently not implemented).
- d) Interrupt control logic.
- e) Control circuit for Laser modulation.
- f) Buffers and shift registers for optional bit serial I/O channels.
- g) Control logic for f).
- h) Interface to the parallel and serial output which contains:
 - (1) buffers and shift registers for XYZ serial I/O channels,
 - (2) control logic for h)(1).
- i) Control logic for graphics output (not implemented)

HelperCard Block Diagram



Conventions

Throughout the manual you will see graphic icons representing pertinent information in the text. The purpose of these icons is to provide a visual convention to alert you of a stop in the flow of the manual, where an important note or safety hazard alert is posted.

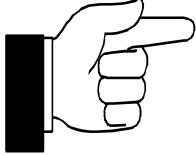

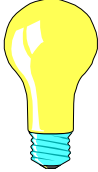


NOTE is an important procedure you should be aware of before proceeding.

CAUTION alerts you of a potential danger to equipment or the user.

WARNING indicates an imminent danger to the user.

TIP and **REMINDER** are helpful hints to procedures listed in the text.

The conventions are listed as follows, showing both the text and the picture you will see.

NOTE	CAUTION	TIP	WARNING	REMINDER
				

1.1 Warranty

GSI Lumonics (GSLI) warrants this product to be free from defects in materials and workmanship for 12 months from the date of shipment. GSLI will, at its option, repair or replace the product if it is defective within the warranty period and returned, freight pre-paid, to a service center designated by GSLI.

GSI Lumonics requests that customers obtain a Return Authorization Number prior to returning units, and that they carefully pack units in their original packing or equivalent.

Under warranty, GSLI is not obligated to repair damage to any units resulting from the following conditions (customers are responsible for defining which conditions are applicable to their product):

- a) Personnel other than GSLI representatives attempting to repair or service the product.
- b) Improper use of the equipment.
- c) Connecting the product to incompatible equipment.
- d) Personnel other than GSLI representatives modifying the product.
- e) Scratches and chips on any optical surface after three weeks from the date of receipt.
- f) Damage to any optical surface from improper handling or cleaning procedures. This applies specifically to those items subjected to excess laser radiation, contaminated environments, extreme temperature or abrasive cleaning.

Customers assume all responsibility for maintaining a laser-safe working environment. OEM customers must assume all responsibility for **CDRH** (Center for Devices and Radiological Health) certification.



NOTE

There is no implied warranty of fitness for a particular purpose, and GSLI is not responsible for consequential damages. Individual components manufactured by GSLI or others may be covered by their own warranties. Refer to the appropriate manuals for this information.

1.2 Customer Support

GSI Lumonics has support services available to you concerning problems with either the product or manual you are using.

Before calling for assistance, please make sure you refer to any appropriate sections in the manual that may answer your questions.

The “Technical Outline Drawings” may be particularly helpful. If you need further assistance:

The customer service personnel will be able to give you direct assistance and answers to your questions.



CALL

U.S. (Massachusetts):	978-661-4300 (in the U. S.) +01 978-661-4300 (outside the U. S)
Germany (Munich):	+49 89 899134-0
Italy (Monza):	+39 39 2025387
UK (Banbury):	+44 132-787-2424
Japan (Tokyo):	+81 3 3406 7990

... ask for the GMAX Customer Service Department

1.3 Unpacking

The package you receive will include those items mentioned in the packing list is included in the shipment that details the exact items shipped.

- a) CAREFULLY unpack the contents from the box.
- b) Save shipping container and packaging material in case you need to return unit for service.
- c) Check contents of the box against the packing list to assure all parts have been received.
- d) Inspect each item to assure it is not damaged.

2. SET-UP PROCEDURE



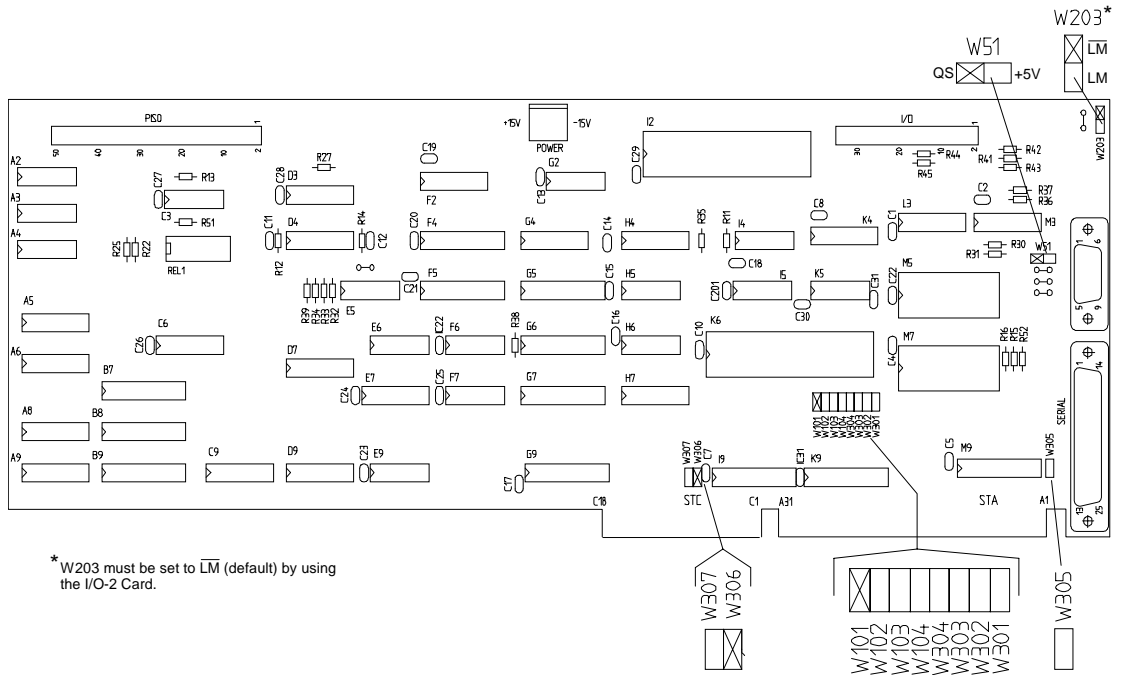
CAUTION

Static electricity can damage the printed circuit boards of the PC and HelperCard. Perform all work in a static-free environment, and ground hands with grounding wrist straps.

2.1 Jumper Settings

The following outline of the **HelperCard** shows the location of the various jumpers.

Jumper Locations



* W203 must be set to LM (default) by using the I/O-2 Card.

2.1.1 Interrupt and I/O Address

*Interrupt and I/O
Address Settings*

The **HelperCard** is supplied with the Interrupt set at IRQ10 (jumper in position W306) and the I/O address set at 01A0H_{Hex} (a jumper in position W101).

If you are concerned about a conflict with the hardware already installed on your computer, you will have to determine which addresses and interrupts are available.

If it is necessary to change the interrupt and/or the I/O Address, refer to the following table for address and interrupt jumper positions.

*Interrupt and I/O
Address Table*

HELPERCARD BASE ADDRESS SELECT		HELPERCARD INTERRUPT SELECT	
JUMPER POSITION	I/O ADDRESS	JUMPER POSITION	INTERRUPT SELECT
W101*	01A0H*	W301	IRQ7
W102	0280H	W302	IRQ5
W103	02A0H	W303	IRQ4
W104	0340H	W304	IRQ3
		W305	IRQ9
		W306*	IRQ10*
		W307	IRQ11

* Indicates the default settings for Interrupt and Base Address



NOTE

The address settings of PC-MARK must match the address settings of the HelperCard. (Refer to the PC-MARK manual; MCL.INI)

2.1.2 Laser Modulation (LM)

*Laser Modulation
Jumpers*

The jumper W203 determines laser modulation polarity. Set the jumper according to your laser.

The jumper W51 is used to select the Output on pin 6 (QS or +5V) of the external I/O connector.

2.2 Laser Safety/Shutter

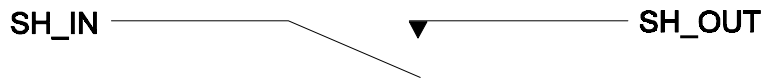


CAUTION

The use of this feature should not replace the "safety and warnings" referenced in all GSI Lumonics XY Scan Head Manuals. Described are key considerations in "Laser Shutter Installation" and "Installation Safety Requirements". Services of additional information on laser safety are also listed.

To improve the laser safety, the shutter should be connected in series with SH_IN and SH_OUT.

This enables the Shutter control line only when the computer is switched on. This function is available with the I/O-2 add-on card.



Contact rating

- max. 48V
- max. 0.5A
- switch on resistance max. 200mΩ

For more information refer to "APPENDIX A: I/O-2 CARD" in this manual.

3. INSTALLATION

*HelperCard
Installation*

To install the **HelperCard** into the computer:

- 1) With the computer and the monitor power off, remove the computer's cover.
- 2) Select a full length slot on the motherboard. Remove the existing slot blank and retaining screw.
- 3) Firmly insert the **HelperCard** into the slot. Verify that the 9 and 25 pin connectors will face outward of the PC cover when the cover is reinstalled.
- 4) Secure the board to the computer with the retaining screw.
- 5) Replace and secure the computer cover.

3.1 Minimal Computer Requirements

The minimal configuration for the computer is as follows:

*Minimal Computer
Requirements*

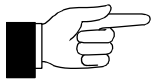
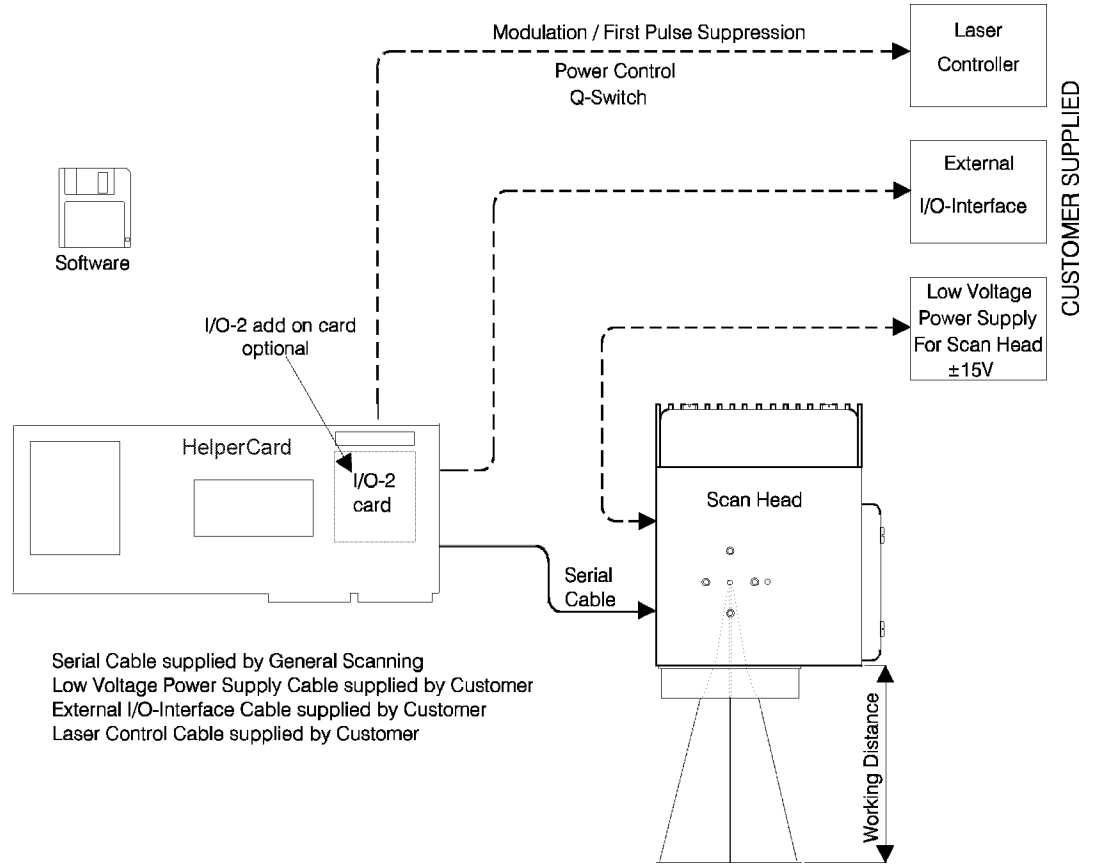
COMPUTER MINIMAL CONFIGURATION	
Processor	80386 / 80486
Bus Clock Frequency ¹⁾	maximum 13.2 MHz and minimum 1 Wait State
MS-DOS®	Version 5.0 or greater
RAM	2 MB recommended
Graphic Card	VGA (16 Bit)
Monitor	VGA - Color
Mouse	Microsoft® Mouse or compatible
Extension Slot	Minimum one 16-Bit
Hard Disc	Minimum 5 MB free
Floppy Disc	3.5 " / 1.44 MB

¹⁾ only for HelperCard, not required for HC/2.

4. INTERCONNECTIONS

The following figure depicts the connection of the **HelperCard** to an GSI Lumonics **XY Scan Head** and the various other Customer-supplied parts of the system.

HelperCard Connected to a System

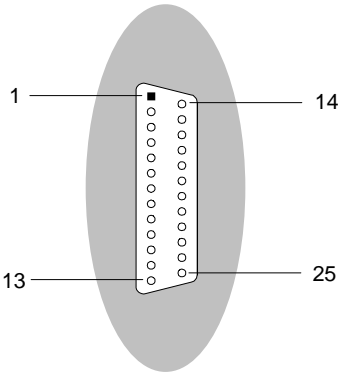


NOTE

For installation of the PC-MARK software refer to PC-MARK manuals.

4.1 Serial Link Connector

The **HelperCard** has a connector for the serial link to a GSI Lumonics **XY Scan Head** or **HCI** card. This connector is mounted on the rear end of the **HelperCard**.

INTERFACE	PIN	ASSIGNMENT
 <p data-bbox="521 1100 891 1157">25 Pin D-Sub female connector for Scan Head</p>	1	SENDCK -
	14	SENDCK +
	2	SYNC -
	15	SYNC +
	3	CHANNEL X -
	16	CHANNEL X +
	4	CHANNEL Y -
	17	CHANNEL Y +
	5	RESERVED FOR Z AXIS
	18	RESERVED FOR Z AXIS
	6	STATUS -
	19	STATUS +
	7	OPTION1 -
	20	OPTION1 +
	8	OPTION2 -
	21	OPTION2 +
	9	LM -
	22	LM +
	10	NC
	23	SHIELD GROUND
	11	SHIELD GROUND
	24	SHIELD GROUND
	12	NC
	25	SHUTTER OUT
	13	SHUTTER IN



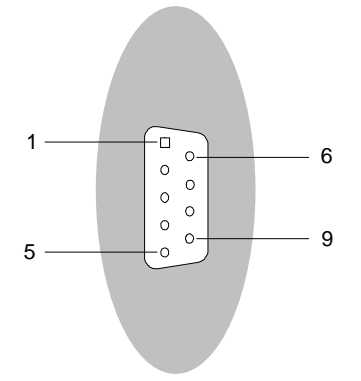
PIN assignment shown for reference only.

NOTE

4.2 External I/O Connector

The **HelperCard** has a connector for an external connection to a customer interface. This connector is mounted on the rear end of the **HelperCard** and has 9 pins connected as follows:

External I/O Connector

INTERFACE	PIN	ASSIGNMENT
 <p data-bbox="527 913 885 976">9 Pin D-Sub female connector for external I/O interface</p>	<p data-bbox="982 598 998 892">1 6 2 7 3 8 4 9 5</p>	<p data-bbox="1047 598 1218 892">GND QS or +5 V LM_OUT PC2 (INPUT) PC3 (INPUT) PC5 (OUPUT) PC0 (INPUT) PC7 (INPUT) PC4 (OUTPUT)</p>

For the Pin for Pin description see the following page.

Pin for Pin Description

Pin 1	(GND) is connected to the Logic Ground of the card and connects to the P.C. ground.
Pin 2	(LM) is connected to an open collector gate (7406) and provides Laser modulation. (note: W203 must be set to achieve correct polarity of modulation)
Pin 3	Connects to the I/O chip PC3. It is programmed in the PC-MARK software as an input /MARK_ABORT .
Pin 4	Connects to the I/O chip PC0. It is programmed in the PC-MARK software as an input /BEGIN_MARK .
Pin 5	Connects to the I/O chip PC4. It is programmed in the PC-MARK software as an output /MARK_IN_PROGRESS .
Pin 6	Connects to the output QS or +5 V output through jumper W51.
Pin 7	Connects to the I/O chip PC2. It is programmed in the PC-MARK software as an input /LASER_ERROR .
Pin 8	Connects to the I/O chip PC5. It is programmed in the PC-MARK software as an output /REMOTE_EXECUTE .
Pin 9	Connects to the I/O chip PC7. It is programmed in the PC-MARK software as an output /MARK_ERROR .

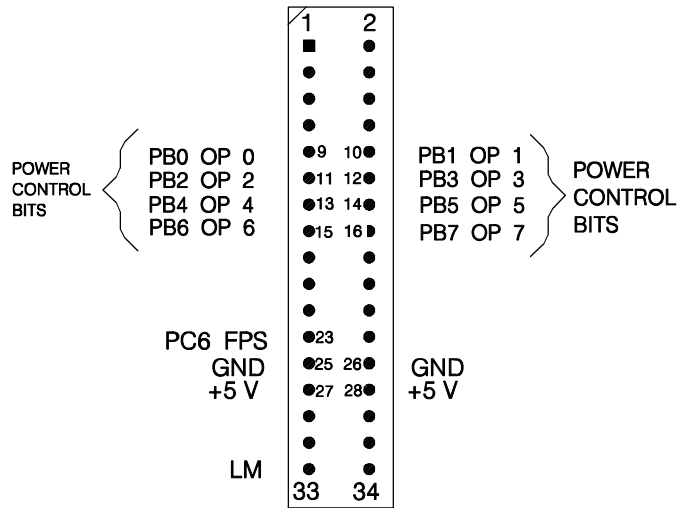
4.3 Internal I/O Connector

HelperCard Internal I/O Connector

This connector provides connections to the Laser Modulator output (as on the 9 pin external connector) and in addition, connections to the FPS (first pulse suppression) output and to 8 bits which are used for power control.

The FPS output and the 8 power control bits are TTL outputs from a PIO chip.

Pin Assignment of I/O Connector



5. APPENDIX A: I/O-2 Card

The **I/O-2** card is an add-on board available as an option to the **HelperCard**. The **I/O-2** features include:

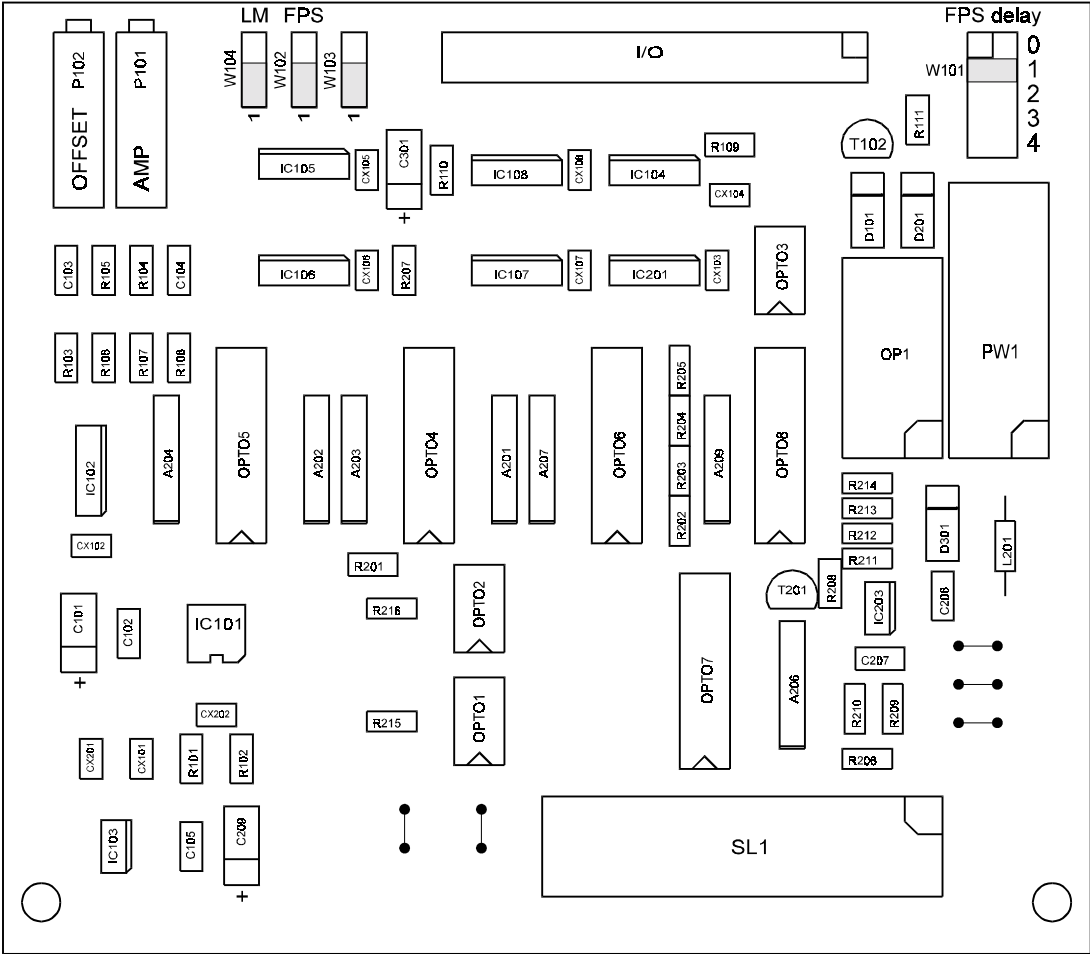
FUNCTION	HELPERCARD	HELPERCARD WITH I/O-2
Laser Modulation output opto-isolated	No	Yes
External voltage for Laser Modulation (+5 to +18 V)	No	Yes
All outputs (on 9-pin con.) opto-isolated	No	Yes
8 bit D/A conv. for analog Power Control (user definable range)	No	Yes
Gate Signal for First-Pulse-Suppression	No	Yes
Jumper selectable 1st, 2nd,...,4th Pulse Suppression	No	Yes
Additional user programmable 8-bit Input (e.g. for system flags) (opto-isolated)	No	Yes

The **I/O-2** is a strongly suggested addition to the **HelperCard** unless the customer wants to design and implement his own opto-isolation circuitry.

YAG applications require an analog output for lamp power control and a gate signal for first pulse suppressions. The easiest way to get these signals is by using the **I/O-2** card.

The following figure is the outline of the I/O-2 Card:

I/O-2 Add On Card



■ = Jumper

5.1 I/O-2 Card Installation

The **I/O-2** card is mounted piggy-back onto the **HelperCard**. The **HelperCard** will have to be removed from the computer, the **I/O-2** card plugged into the **HelperCard**, after the jumpers on the **I/O-2** card are set; then the card assembly re-installed into the computer.

Refer to the **I/O-2 Technical Notes** for information on the jumpers.

The I/O-2 Card Jumpers

To Remove the HelperCard

To remove the **HelperCard**:

- 1) With the computer and the monitor power off, remove the computer's cover.
- 2) Remove the cables from the **HelperCard** output connectors.
- 3) Unplug and remove the **HelperCard** from the computer motherboard.

Connect the I/O-2 Card to the HelperCard

The connector on the solder side of the **I/O-2** card mates to the I/O connector on the **HelperCard**.

- 1) Place screws (M3x6 mm) into the two holes on the **I/O-2** card such that the screw heads are on the component side of the board.
- 2) Insert spacers over the screws.
- 3) Align the connector with the I/O connector on the **HelperCard** and press them together.
- 4) The two panels are then secured by placing flat and lock washers then nuts on the solder side of the **HelperCard**.

Re-install the Card Assembly

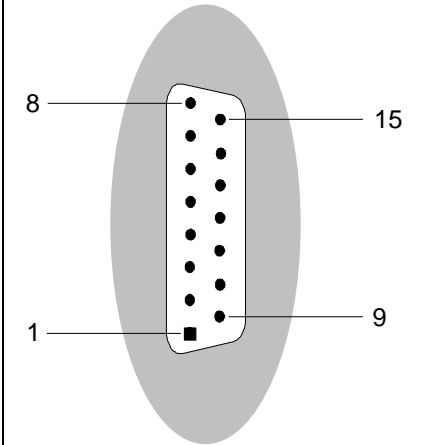
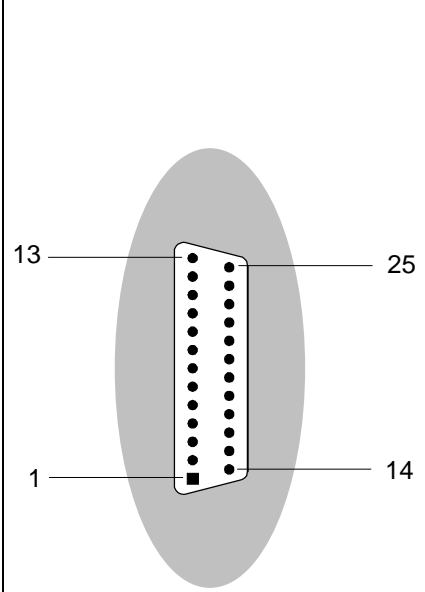
To install the card assembly, you will need two adjacent 16 bit slots. One slot will house the **HelperCard**, the second slot will be used to mount the two connectors on the ends of the ribbon cable coming from the **I/O-2** card.

- 1) Firmly insert the Card Assembly into one slot.
- 2) Secure the **HelperCard** to the computer with the retaining screw.
- 3) Remove the slot blank from the adjacent slot.
- 4) Secure the Connector assembly to the computer with the retaining screw.
- 5) Replace and secure the computer cover.

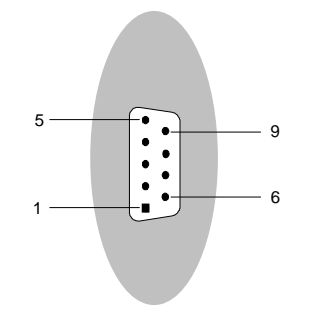
5.2 I/O-2 Card Interconnections

Reconnect the Serial Interface cable, coming from the **XY10A** Scan Head, to the **HelperCard** connector.

The pin configuration for the two connectors, connected to the ribbon cable coming from the **I/O-2** Card are as follows:

INTERFACE CON1	PIN	ASSIGNMENT	NOTES
 <p>15 Pin D-Sub male connector</p>	8	STOP_MARK	
	15	/STOP_MARK	
	7	BEGIN_MARK	
	14	/BEGIN_MARK	
	6	+5 V	+5 V output
	13	GND	Ground output
	5	SH_IN	Shutter relay contact
	12	SH_OUT	Shutter relay contact
	4	/LP_COUT	0 V = Remote current control
	11	LOCAL	0 V = Remote control
	3	LP	Lamp current (0 to 10 V)
	10	LP_RETURN	Ground output
	2		
	9	GND1	External input
	1	+VSS1	External input (+15 to +18 V)
INTERFACE CON2	PIN	ASSIGNMENT	NOTES
 <p>25 Pin D-Sub male connector</p>	13	GND	Ground
	25	/RFO RETURN	RF modulator over temp.
	12	/RFO	Ground
	24	/MCO RETURN	Modulator crystal over temp.
	11	/MCO	Ground
	23	/LFP RETURN	Low forward power flag
	10	/LFP	Ground
	22	/HRP RETURN	High reverse power flag
	9	/HRP	External Ground
	21	GND	External input (+15 to +18 V)
	8	+VSS2 INP.	Ground
	20	/REMOTE RETURN	Remote flag
	7	/REMOTE	
	19		
	6		
	18	GND	
	5	+VCC2	First pulse suppression
	17	/FPS	
	4	+VCC2	Laser Modulation
	16	/GATE	
	3	+VCC2	
	15	XB (GROUND)	PIN 14/15 are for Mode GATED-CW connected together.
	2	+VCC2	
	14	XA (+VCC2)	PIN 14/15 are for Mode GATED-CW
	1	+VCC2	Pin 1,2,3,4,5 are connected. together.

The following is the pin configuration of the I/O-2 Card optional interface connector which is located on the card:

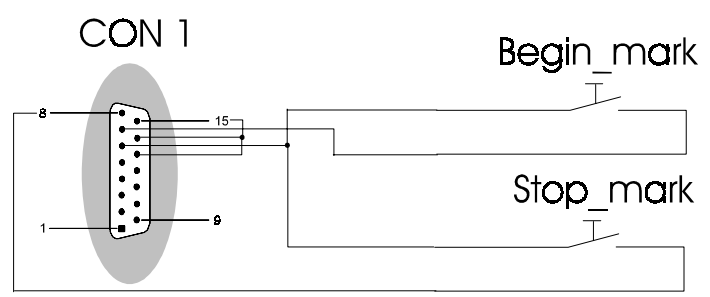
INTERFACE	PIN	ASSIGNMENT
 <p>9 Pin D-Sub male connector</p>	5	not connected
	9	/OPT4
	4	OPT4
	8	/OPT3
	3	OPT3
	7	/OPT2
	2	OPT2
	6	/OPT1
	1	OPT1

5.2.1 CON1 (15 Pin D-Sub Connector)

5.2.1.1 STOP_MARK & BEGIN_MARK

5.2.1.1.1 W/O Opto-Isolation

*W/O Opto-Isolation
(using the internal +5V
from the PC)*

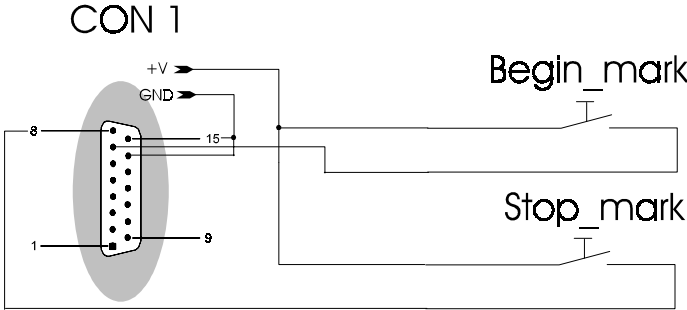


- connect Con 1 Pin 13 (ground output) to Pin 14 & Pin 15
- connect Con 1 Pin 6 (+5V output) to the switches for STOP_MARK and BEGIN_MARK
- connect Con 1 Pin 8 to the return line of the STOP_MARK switch
- connect Con 1 Pin 7 to the return line of the BEGIN_MARK switch

There is no extra external voltage needed if only the STOP_MARK and BEGIN_MARK function of the customer interface CON1 is used.

5.2.1.1.2 With Opto-Isolation

*With Opto-Isolation
(using an external
voltage)*



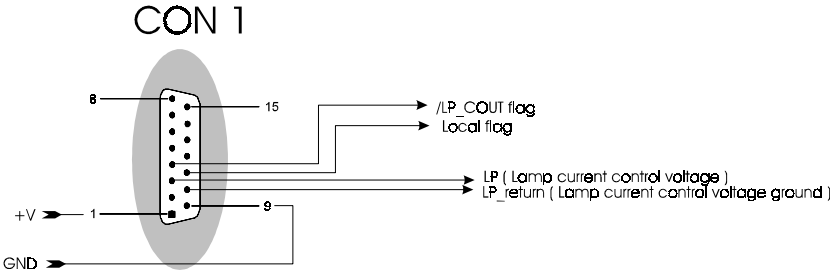
- connect Con 1 Pin 14 & Pin 15 with the external voltage ground .
- connect the external voltage (+2.5V to max. 18V) to the switches for BEGIN_MARK and STOP_MARK
- connect Con 1 Pin 8 to the return line of the STOP_MARK switch connect Con 1 Pin 9 to the return line of the BEGIN_MARK switch

5.2.1.2 Flags and Lamp-Current

There are two Flag outputs ,

- remote current control (/LP_COUT)
- remote control (LOCAL)

Interconnection of the customer interface:



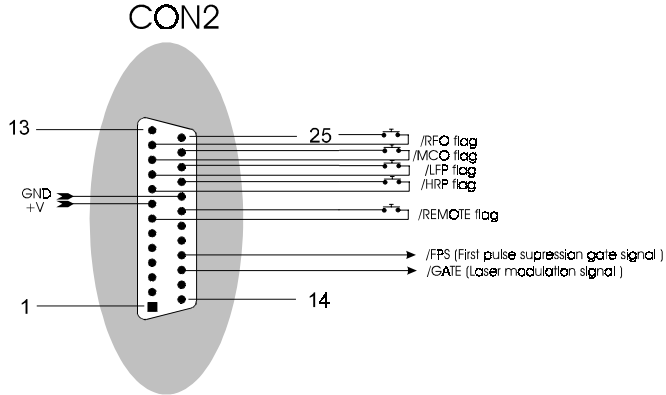
The external voltage has to be supplied to the CON1 connector if the flags and / or the lamp current control voltage are to be used.

In order to use the safety shutter function it is sufficient to just connect the shutter lines.

5.2.2 CON2 (25 Pin D-Sub Connector)

5.2.2.1 HF-driver interface

The HF-driver interface is compatible with the *Spectron Laser Systems* HF-drivers.



The external voltage is normally 18 V (-17 % + 0%).

5.3 I/O-2 Card Technical Notes

Laser Current Control (LP)

The Laser Current Control circuitry delivers a Voltage between 0.7 to 10V. It is galvanic isolated from the PC. It can be used to drive power control circuitry of the laser.

The output is controlled through the application software (**PC-MARK & JOB EDITOR**).

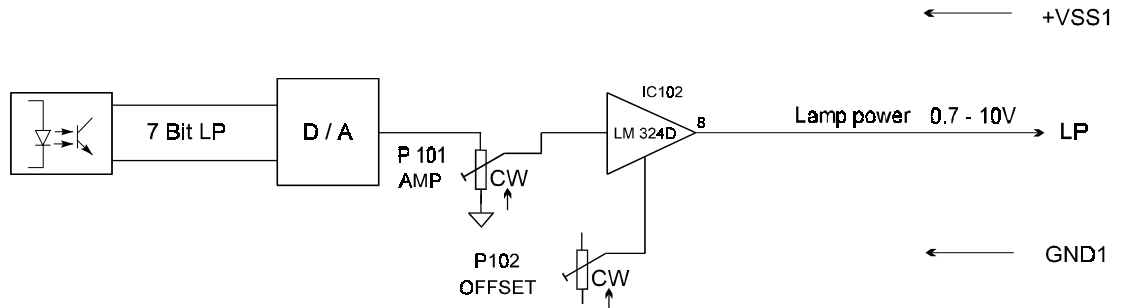
The **PC-MARK & JOB EDITOR** programs send:

- Hex 7F for the lowest output level
- Hex 00 for the highest output level

via the **HelperCard** to the **I/O-2** card.

The lowest output level is adjustable with P102; min = 0.7V, max. = 5V.

The highest output level is adjustable with P101; max. = 10V.



The standard settings are 2 V low level, 10 V high level. The external power input +VSS1 ranges from min +15 V to max. 24 V relative to GND1 with maximum 150 mA.

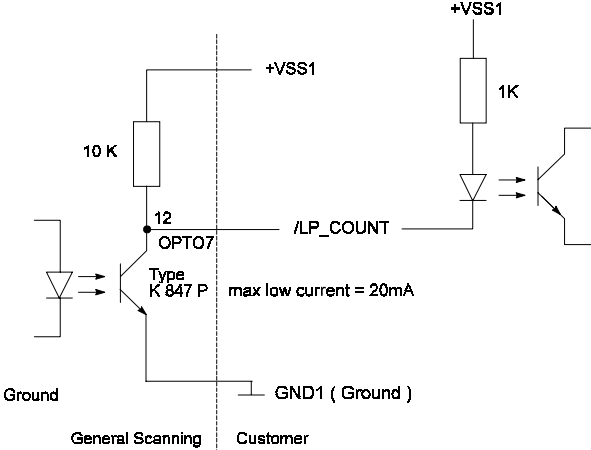
The external power input (+VSS1, GND1) requirement is:

- min. +15 V to max. 24 V at 150 mA current input.

Remote Current Control Flag (/LP_COUNT)

The remote current control flag is an opto-isolated output. It indicates that the lamp current circuitry is being controlled through the **HelperCard**.

- 0 = control through the **HelperCard**
- 1 = no control through the **HelperCard**.



Mode Selection for the Spectron Laser HF-Driver.

To control the HF-driver through the **HelperCard**, it is necessary to select the GATED CW mode on the HF-driver. This is done with the following external mode selection inputs:

- /A = +VCC2
- /B = GND2

When "REMOTE" is selected on the mode switch (HF-driver) then the external mode selection is activated.

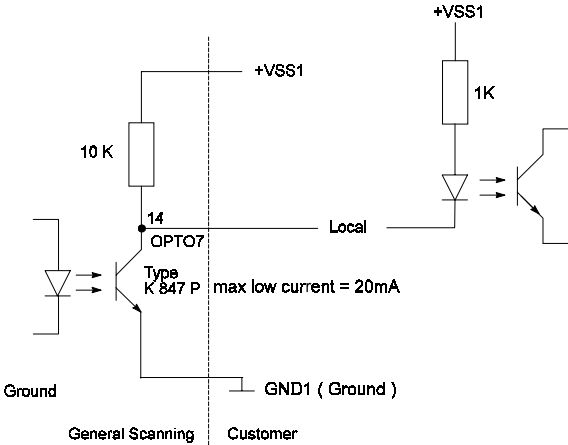
Remote Flag

The remote flag indicates that the mode selection of the HF-driver is used (computer control):

- 0 = Remote
- 1 = Local

This information is available through the **HelperCard** for application programs (e. g. **PC-MARK & JOB EDITOR**).

At the same time, the Remote flag is available through an opto-isolator as a local flag.

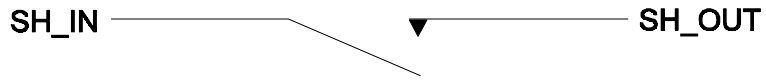


Local = 0V = Remote control through the **HelperCard**.

Laser Safety

To improve the laser safety, the Shutter should be connected in series with **SH_IN** and **SH_OUT**.

This enables the Shutter control line only when the computer is switched on.



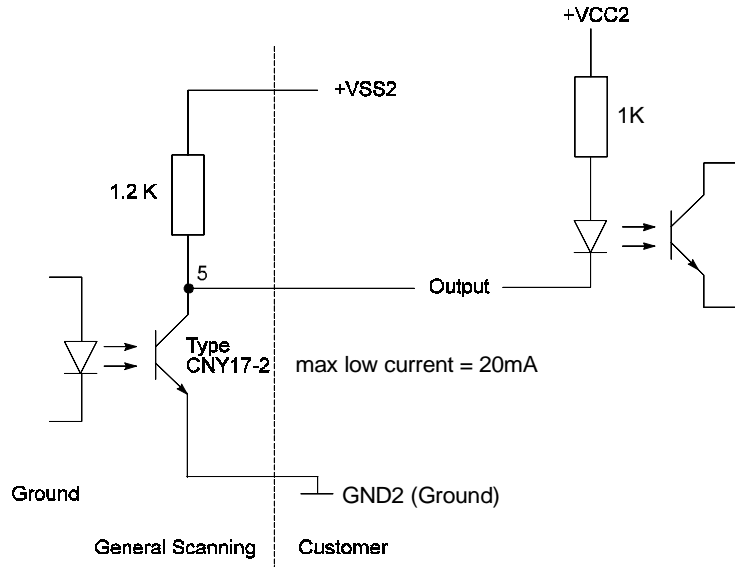
Contact rating:

- max. 48V
- max. 0.5A
- switch on resistance max. 200mW

Laser Modulation and First Pulse Suppression

Laser Modulation (LM) and First Pulse Suppression (FPS) outputs have opto-isolators as driver circuitry. The external supply +VSS2 may be between +5 V and +18 V relative to GND2. The external supply supplies all points labeled +VCC2 and GND2.

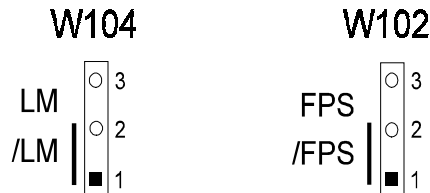
Configuration of the Opto-Isolator



The /LM-signal is opto isolated through the IC OPTO2 and the /FPS signal through the IC OPTO1

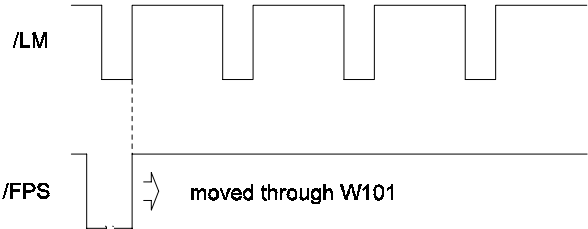
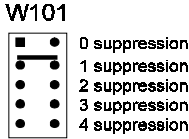
Inverting the Signals

To meet the need of inverting the signals use bridge W102 for the FPS signal and bridge W104 for the LM-signal. Standard settings for LM and FPS are as shown:



APS Delays

The first pulse suppression can be re configured to a zero, first and second pulse suppression a.s.o. up to a maximum of 4 pulses (with bridge W101). The default setting is first pulse suppression.



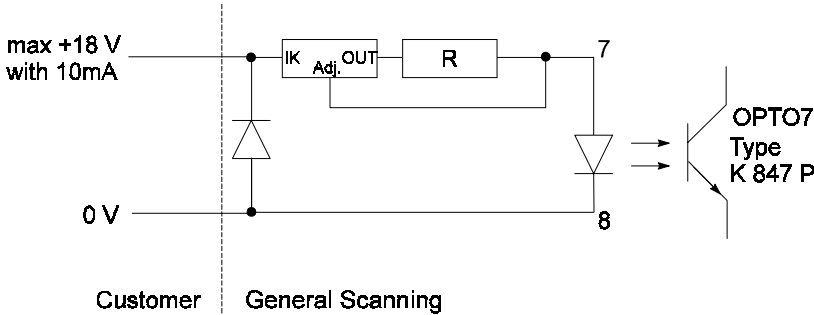
BEGIN_MARK & STOP_MARK

The **STOP_MARK** and **BEGIN_MARK** inputs are opto-isolated. The configuration of the opto-isolator is set to react with a minimum of 2.5V between the input lines. The maximum voltage between the input line should not exceed 18V. The inputs are normally used with an input voltage range from +5 V to 18V.

BEGIN_MARK

The **BEGIN_MARK** input starts the marking through the application programs (e.g. **PC-MARK & JOB EDITOR**)

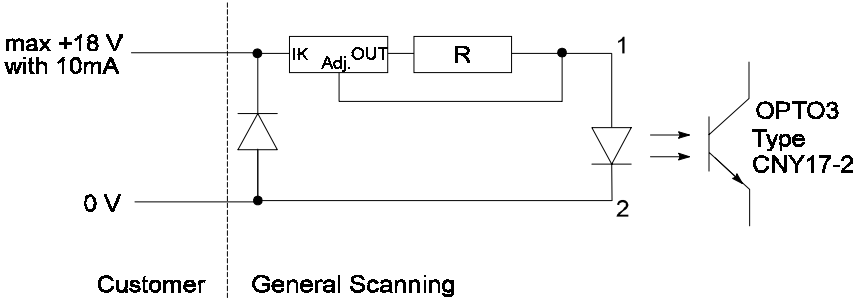
Configuration of the opto-isolator is as shown:



STOP_MARK

The rising edge of the input voltage triggers the **STOP_MARK** function.

Configuration of the opto-isolator is as follows:



The configuration of the STOP_MARK function can be as follows:

- With the bridge W103 connected between pin 2 & pin 3 used as opto-isolated input for /mark abort, to stop the marking at the end of the stroke.
- With the bridge W103 connected between pin 1 & pin 2 used to stop the Laser Modulation signal immediately and sets /mark abort to stop the marking at the end of the stroke.

By using the bridge connected between pin 1 & pin 2 the **STOP_MARK** input can be used for trimming applications.

The standard setting of bridge W103 is pin 1 to pin 2.

Alarm Flags

All Alarm flags are readable before and after a job is done through the **HelperCard** from the application programs.

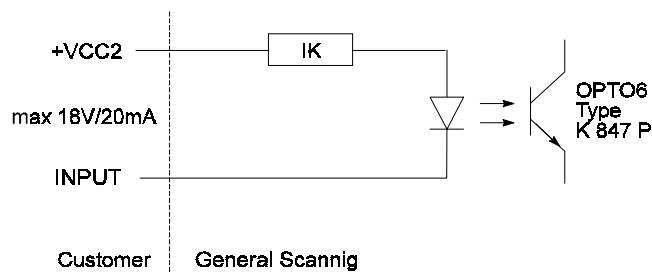
Code definition read back through the **HelperCard**.

BIT	FLAG
1	/HRP
2	/LFP
3	/MCO
4	/RFO
5	/OPT1
6	/OPT2
7	/OPT3
8	/OPT4

The bits are always low if they are connected and no alarm flag is set.

Alarm Flag Input from the HF-Driver

The inputs for the Alarm flags are opto isolate inputs. The Configuration of the inputs are as follows.



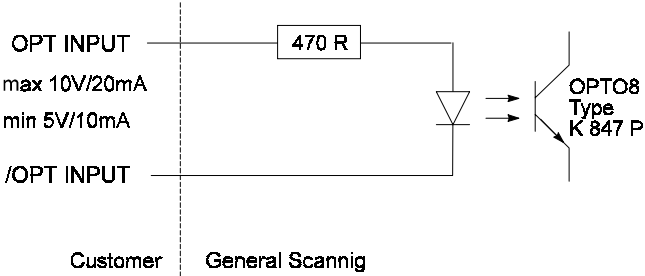
Definition of the alarm flags with the HF driver of SPECTRON LASER SYSTEMS:

- /HRP = high reverse power
- /LFP = low forward power
- /MCO = modulator crystal over temperature
- /RFO = RF modulator driver (heat sink) over temperature

All Spectron alarms are voltage free normally open contacts. They are closed with no error (closed = healthy, open = on alarm).

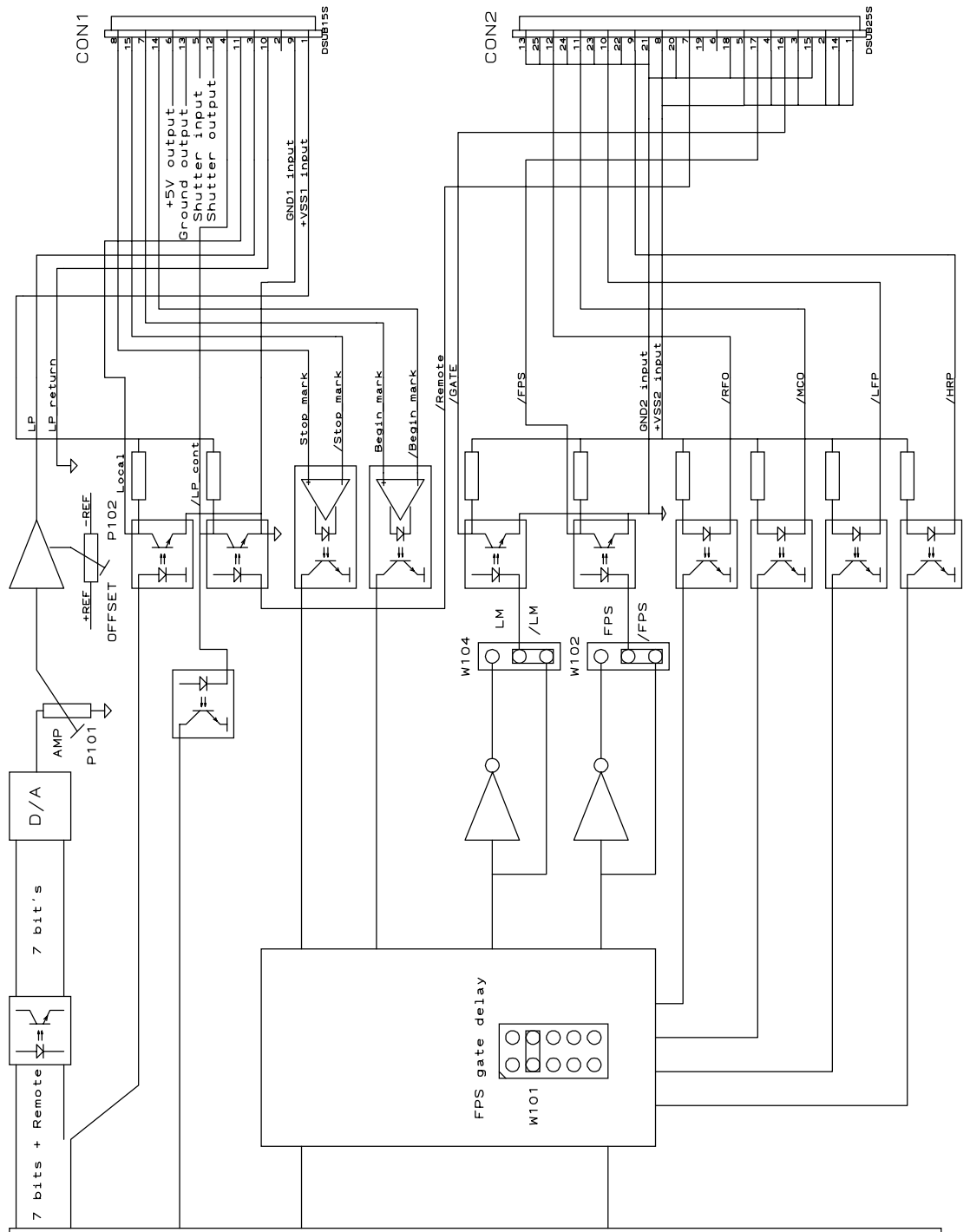
Optional Input Flags

The inputs for the optional input flags are opto-isolate inputs.
Configuration of the inputs are as follows:



The optional input flags are only available on request of the customer.

5.4 Block Diagram I/O-2



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