



IVD : INTELLIGENT VALVE DRIVER USER MANUAL

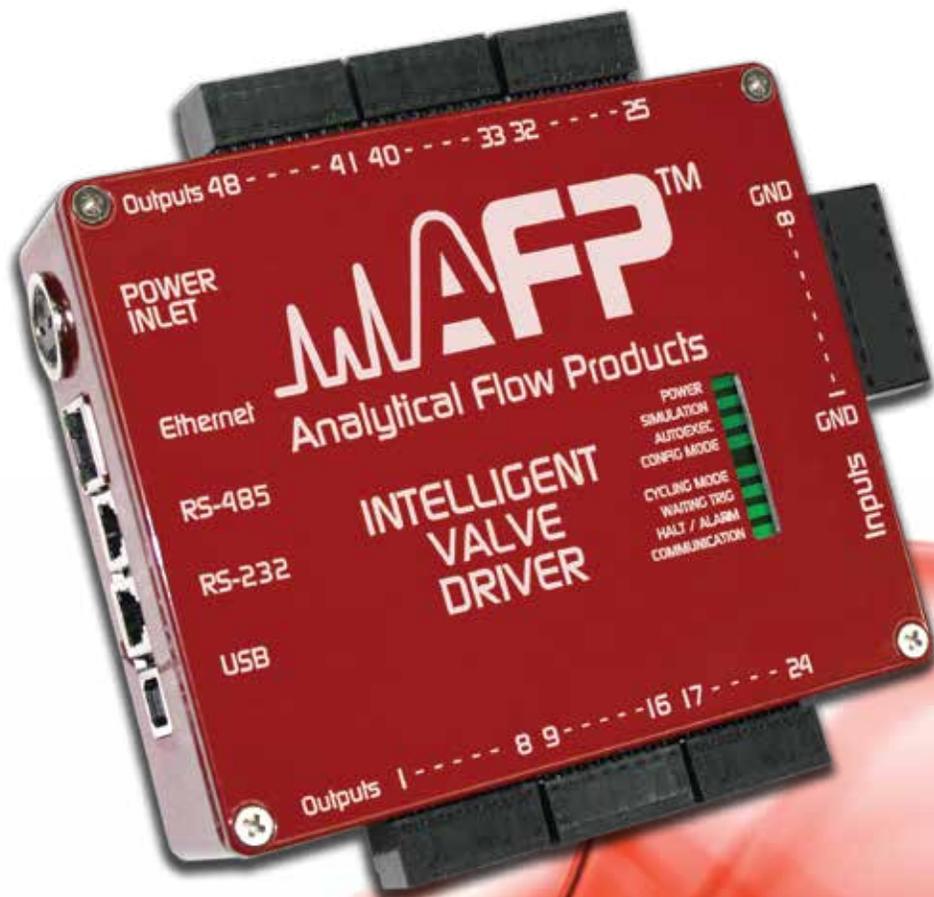


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- C.** Effects of heat: Do not put the unit anywhere near sources of heat, such as radiators, hot-air shafts, ovens, etc.
- D.** Power source: Connect the unit only to the power source indicated on the operating instructions or on the unit.
- E.** Foreign bodies: Take a great care to ensure that no liquids or other foreign bodies can find their way inside the unit through the openings in the casing.

* IVD, EAC, EDV products.

LIMITED WARRANTY

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3. If AFP is satisfied that the Product is covered by the present warranty, AFP shall have the option, at its sole discretion, to either: (i) repair the Product, (ii) replace the Product, or (iii) refund the initial purchase price paid for the Product. AFP reserves the right, at its sole discretion, to use reconditioned parts or Products for warranty replacements or repairs. Replaced or repaired Products shall only be warranted for the remainder of the Warranty Period applicable to the Product purchased initially.
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6. Products must be shipped back to AFP in either its original packaging or packaging offering an equal degree of protection and the Products must be returned free of any hazardous substances.

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15. The warranty granted hereunder extends solely to Client and shall not be assigned to any other person or entity.
16. This warranty supersedes all prior proposals or representations, whether written or oral, and constitutes the entire agreement between the parties. It may not be expanded or modified except in writing signed by both parties hereto.
17. This limited warranty shall be governed by and construed in accordance with the laws of the Province of Quebec and of Canada applicable therein without regard to its principles of conflicts of law, and the courts of the Province of Quebec, judicial district of Frontenac shall have exclusive jurisdiction with respect to any dispute or proceeding in respect with this limited warranty or any other dispute that may arise between the Client and AFP.
18. In the province of Quebec: the parties have requested that this warranty and all documents relating thereto be drafted in English. Dans la province du Québec : les parties concernées par les présentes ont exigé que cette garantie ainsi que tout document s'y rapportant soient rédigés en anglais.

INTRODUCTION

The IVD (intelligent valve driver) is a very powerful system which is much more than a simple valve driver interface. Indeed it comes with fill in the blank type configuration software and some other useful tools. Four communication channels are available (TCP/IP, RS-485, RS-232, and USB) to meet most remote control interface requirements.

In an esthetic enclosure the IVD provides 48 powerful digital outputs and 8 electrically isolated digital inputs. The outputs are suited to control miniature solenoids like in GC applications or directly electric / electronic valves like in HPLC applications. Both inputs and outputs use screwless connectors to ease installation and service.

Time based event table or switching sequence are easy to configure and execute with the IVD. You can use the IVD_CONFIG software to edit, test, simulate step by step and visualize your configuration in real time from any compatible PC. To use the IVD in standalone mode, the IVD_CONFIG software proposes a simple way to create a timed event table and download it to the IVD permanent memory.

AFP is open to all software integrators that would like to use the IVD in their solution. In this purpose technical information and communication protocol are openly available.

FEATURES :

- RS-485 AFP network compatible
- Ethernet port
- Real time clock
- General digital inputs
- Log and configuration memory
- Industrial screwless connectors
- Could be used as a hub to control EDV series valve
- Trought it serial port the IVD could be control by a Labview™ software
- Open serial protocol for third party application software
- Up to 4 IVD can operate in the same system. Large industrial or valve configuration can be control with the ressource accumulation of:
4 IVD x 48 digitals outputs = 192 Digitals outputs
4 IVD x 8 digitals inputs = 32 Digitals inputs
- USB 2.0 port
- RS-232 port
- Special trig function
- General digital outputs
- Time event sequencer
- Up to 4 IVD
- Industrial Screwless Connection
- The IVD could be control by other hardware products like PLC, Sampling system or directly by a G.C.

1.0 IVD HARDWARE

The IVD is a fast and compact micro controller dedicated to electronic and pneumatic actuated valve. Here is a complete hardware description with pictures and block diagrams.

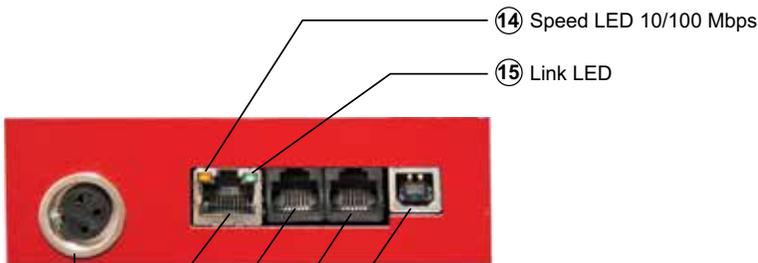
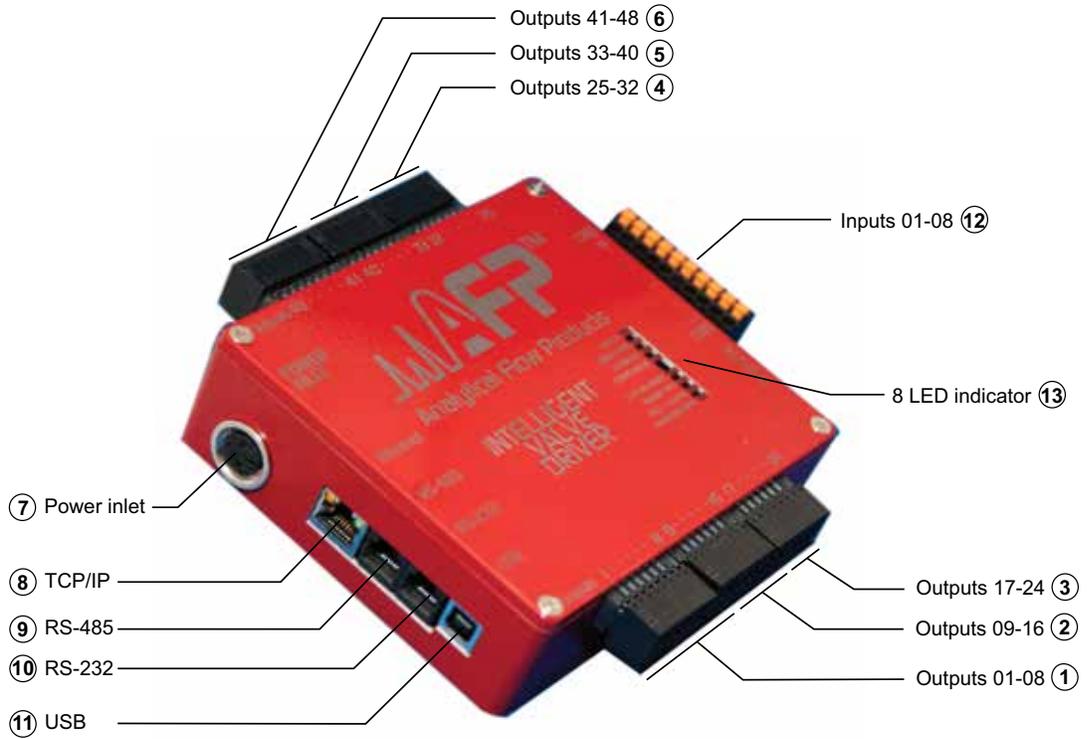
The IVD is also suited to any digital input and digital output operation. It's connector configuration and communication capability make the IVD an easy to use industrial controller.

1.10 GENERAL IVD SPECIFICATIONS

SPECIFICATION	DESCRIPTION	REFERENCE	
8 BITS MICRO CONTROLLER	Flash program with boot loader	⑳	
REAL TIME CLOCK	YY/MM/DD - HH:MM:SS		
DATA LOGGING AND CONFIGURATION MEMORY	Flash Memory in file format		
TIME EVENT TABLE	Flash Memory in text file format		
POWER INLET INTERNAL CONNECTOR	2 Wires connector to PCB	㉕	
MASTER RELAY INDICATOR	1 LED for relay status	㉓	
LED MODULE	1 X 8 LED indicator	⑬	
USB INDICATOR	2 LED for Tx and Rx	㉑	
SPEED LED	LED on RJ-45 connector	⑭	
LINK LED	LED on RJ-45 connector	⑮	
STATUS LED	Processor hart beat led	㉒	
LCD DISPLAY	4 lines of 40 characters	⑱	
25 KEYS KEYBOARD	5 X 5 Matrix Decoder	⑰	
ANALOG INPUT	2 Digital to analog 10 bits	⑲	
ANALOG OUTPUT	One 0 to 5 volts 8 bits analog output	⑯	
AFP NETWORK ADDRESS SELECTOR	Jumper to select 41,42,43,44	㉔	
OPERATING TEMPERATURE	Fahrenheit (°F): 32° F To 158° F Celsius (°C): 0° C To 70° C		
SPECIFICATION	DESCRIPTION	CONNECTOR	REFERENCE
RS-232	9600 Bauds	RJ11-6B	⑩
RS-485 HALF-DUPLEX	9600 Bauds	RJ11-6A	⑨
USB 2.0 (COM PORT EMULATION)	9600 Bauds	TYPE-B	⑪
ETHERNET 10/100 Mbps	9600 Bauds	RJ-45	⑧
48 DIGITAL OUTPUT DRIVERS	12 /24 volts DC	6 connectors	①②③④⑤⑥
8 OPTO ISOLATED DIGITAL INPUTS	8 TO 24 volts DC	1 connector	⑫
SUPPLY VOLTAGE MONITORING	Analog / Digital	10 Bits	
TEMPERATURE MONITORING	Analog / Digital	10 Bits	

1.11 IVD DESCRIPTIVE PICTURE

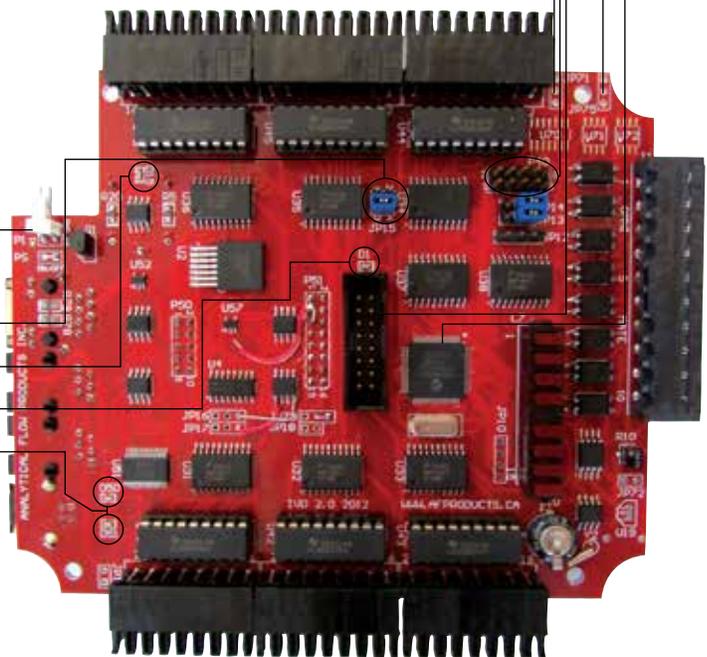
FIGURE 1



- (7) Power inlet
- (8) TCP/IP
- (9) RS-485
- (10) RS-232
- (11) USB

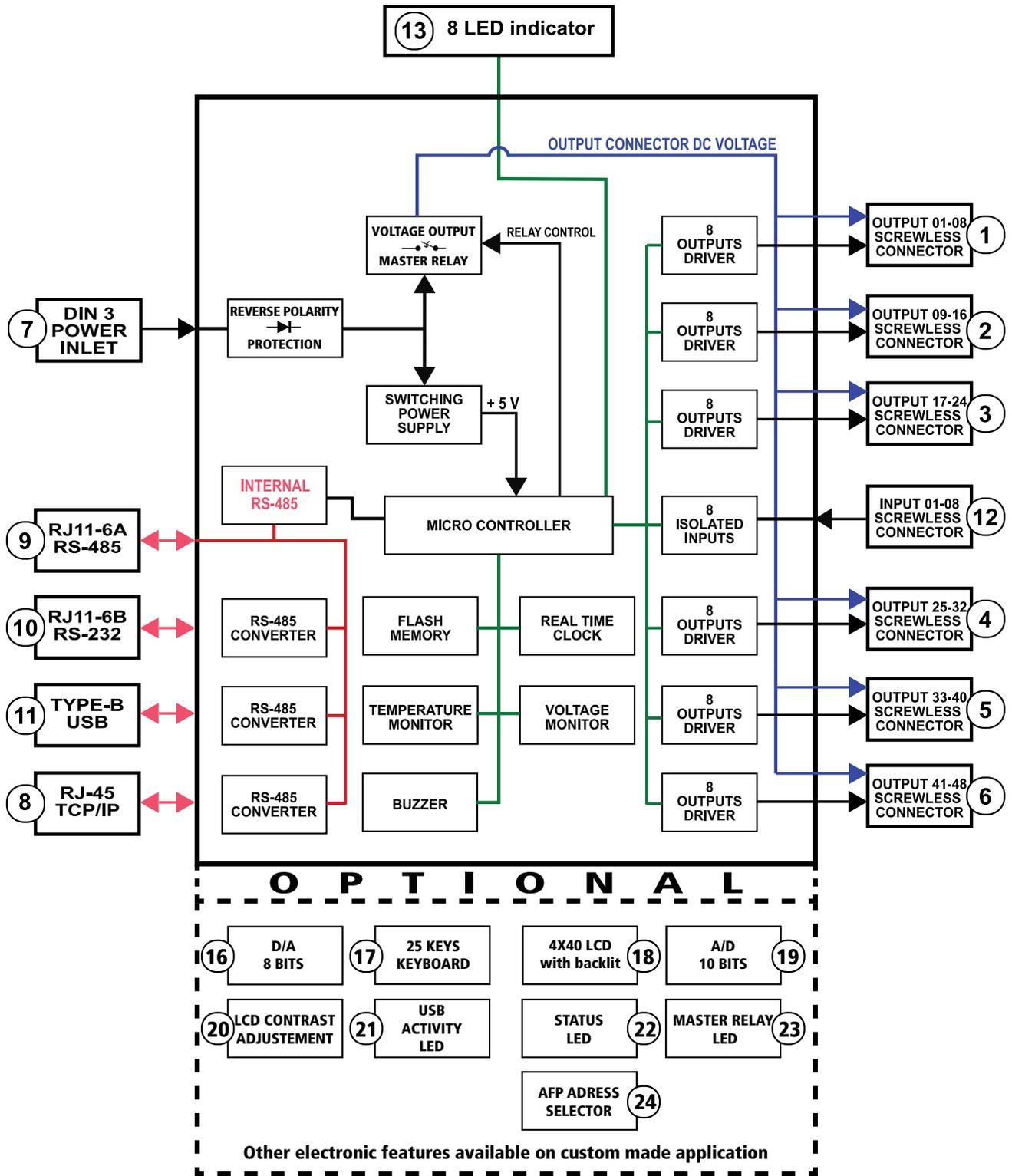
- 8 Bits micro controller (20)
- Analog input (19)
- LCD Display (18)
- 25 Keys keyboard (17)
- Analog Output (16)

- Power inlet internal connector (25)
- AFP Network address selector (24)
- Master relay indicator (23)
- Status LED (22)
- USB Indicator (21)

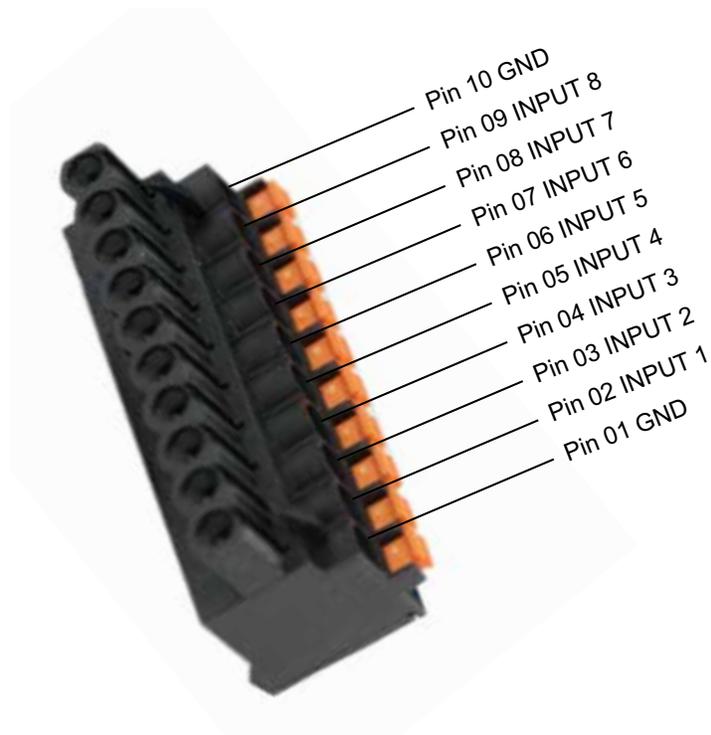


1.12 IVD BLOCK DIAGRAM

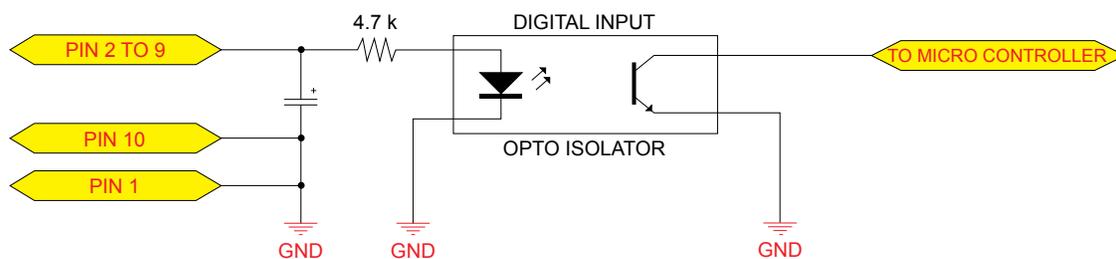
FIGURE 2



1.20 GENERAL INPUT SPECIFICATIONS

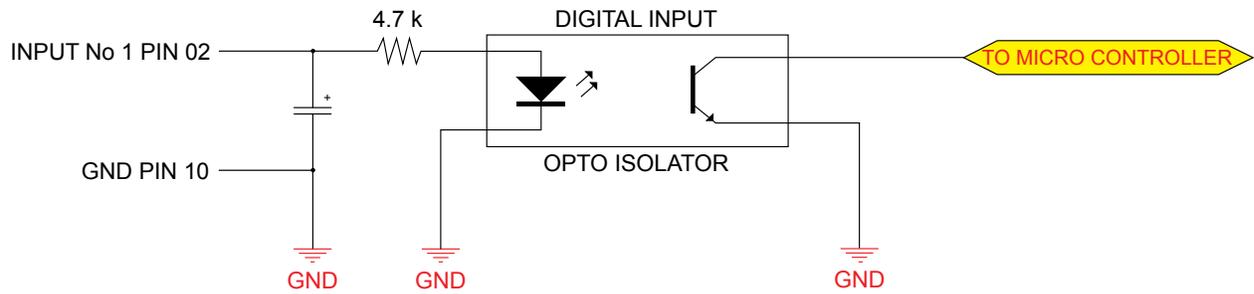


INPUT CONNECTOR



Digital Input Schematic

All Digital Inputs	Opto Isolated
Input current @ 12 Volts DC	12V / 4.7K = 2.55 mA
Input current @ 24 Volts DC	24V / 4.7K = 5.11 mA
Voltage range guaranty "ON" state	8 to 24 Volts DC
Voltage range guaranty "OFF" state	0 Volt DC, Ground (Do not left floating)
Female Connector	Weidmuller
Model	Screwless, Omnimate BLF, 5.00mm
Manufacturer Number	1979350000
Digi-Key Number	281-2674-ND

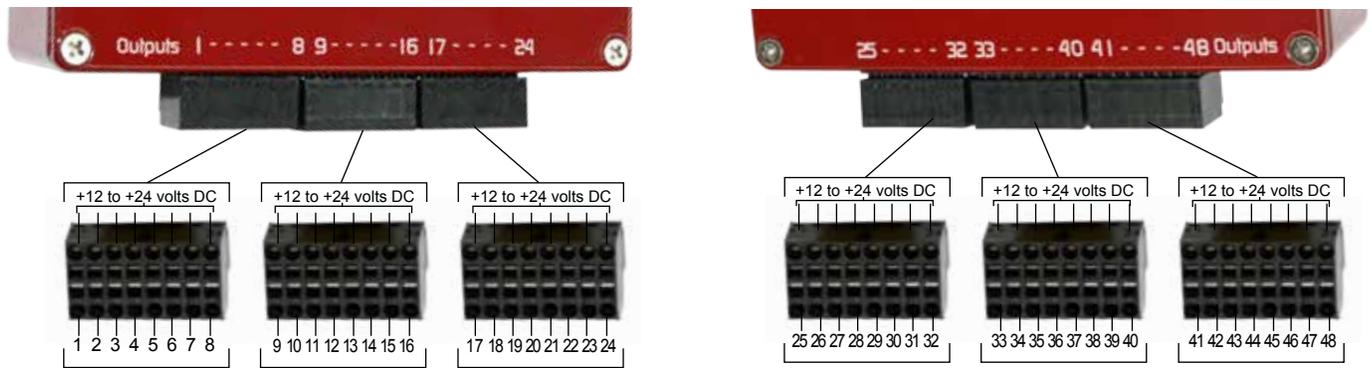


Digital Input Typical Application

1.21 DIGITAL INPUT APPLICATION

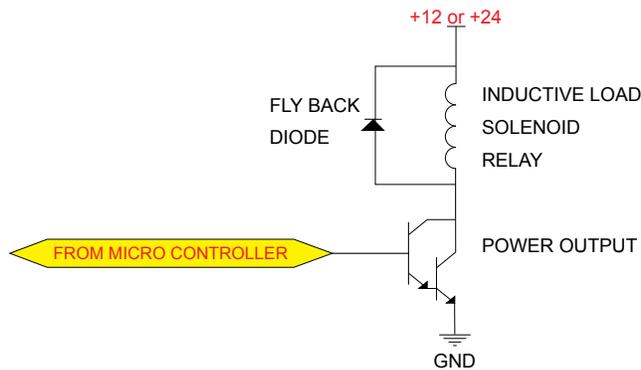
- Multipurpose digital inputs.
- Digital input could read the special trig input used in the AFP sequence program: EVD_CONFIG
- Digital input could be used to read switch, alarm button or any other hardware equipment.
- In other application the digital input could be program to react to binary command or simply translate the binary input to it 48 digitals output state.
- At all time on the AFP network a server using a text command can read all the input state.
- Note that it is not recommend leaving an input “floating”. In a noisy environment false state can be.....
- Note that 5 vols TTL level input is available on demand.

1.30 GENERAL DIGITAL OUTPUT SPECIFICATIONS



OUTPUT CONNECTOR

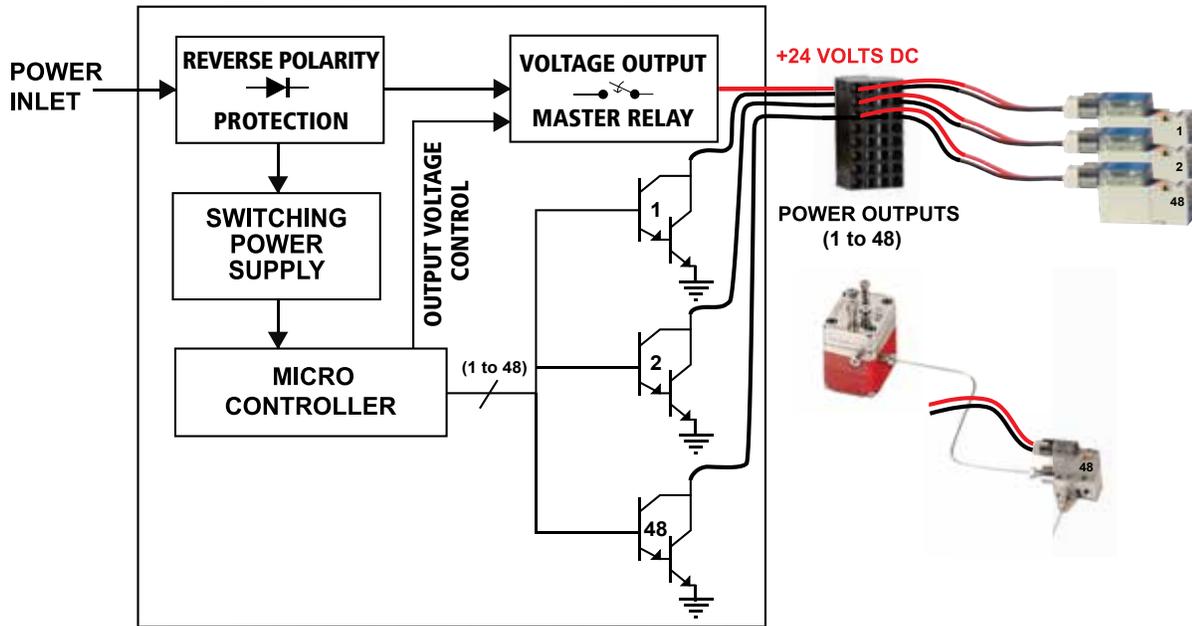
Output pin number depends on where the connector is positioned.



Digital Output Schematic

DESCRIPTIONS	DETAILS
All Digital Outputs	Low side inductive driver
All Digital Outputs	Internal fly back protection diode
Maximum sink current (8 outputs used)	150 mA / output
Maximum voltage	24 Volts DC
Female Connector	Weidmuller
Type	Screwless, Miniature B2L, 3.5 mm
Manufacturer Number	1727690000
Digi-Key Number	281-1853-ND

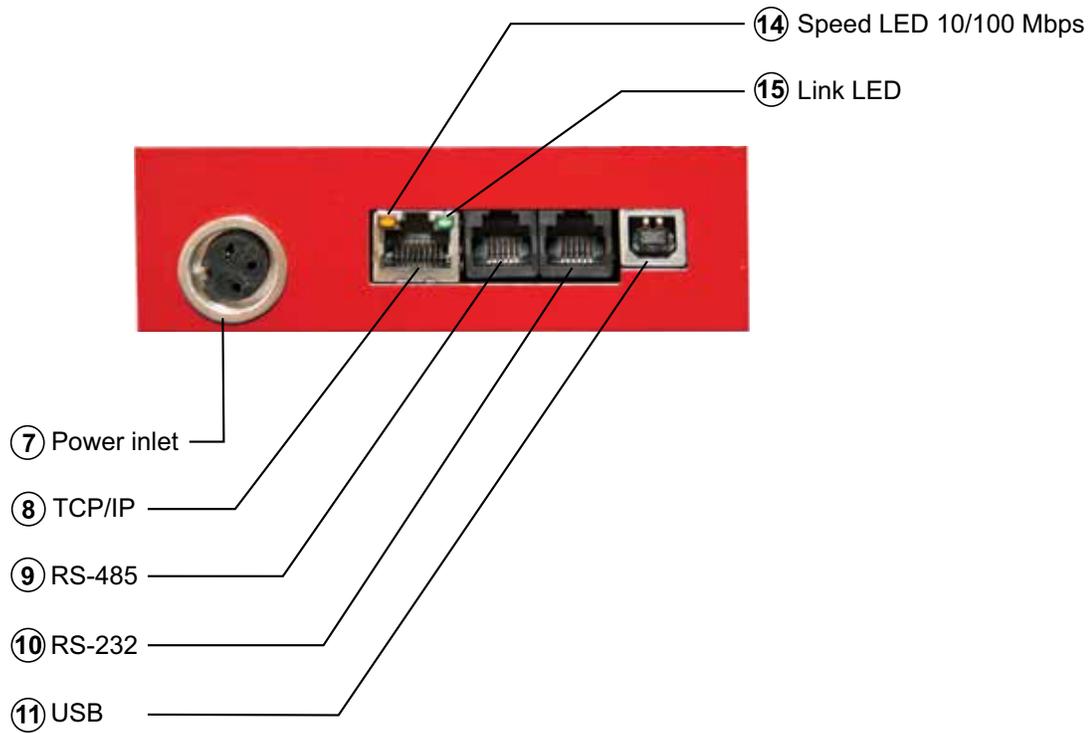
1.3 DIGITAL OUTPUT APPLICATION



Digital Output Typical Application

- Digital Outputs are normally used to drive 2 or 3 ways low power (150 mA maximum) solenoid valve.
- Digital outputs joined to a power relay could control any industrial device.
- In a timed sequence some Digital Outputs could be used to control other elements in the system (Light, Buzzer, and Alarm).

1.40 COMMUNICATION PORTS



CONNECTOR	DESCRIPTION	DETAIL	REFERENCE
DIN 3	Female	Locking	⑦
RJ-45	10/100 baseT	Static IP mode	⑧
RJ-11A	RS-485		⑨
RJ-11B	RS-232		⑩
Type-B	USB	V2.0 High speed	⑪
RJ-45 LED	Orange LED	Speed LED 10/100 Mbps	⑭
RJ-45 LED	Green LED	Link LED	⑮

1.41 INTERNAL NETWORK

All communication ports are internally connected to form a small network. The internal network is RS-485 and is compatible to our RS-485 AFP NETWORK. To do that all communication input are internally converted in RS-485. As you can see in the block diagram of section 1.12 it would be possible to use the IVD as channel converter like TCP/IP to USB or RS-232 to RS-485.

The Network is Half-duplex and communicates at 9600 Bauds. If for any reason, the speed needs to be modified please contact our technical department.

1.42 TCP/IP

To keep the utilization user friendly we selected 4 different static I.P addresses combined to 4 Port numbers.

I.P. Address: 192.168.1.161	Port: 61
I.P. Address: 192.168.1.162	Port: 62
I.P. Address: 192.168.1.163	Port: 63
I.P. Address: 192.168.1.164	Port: 64

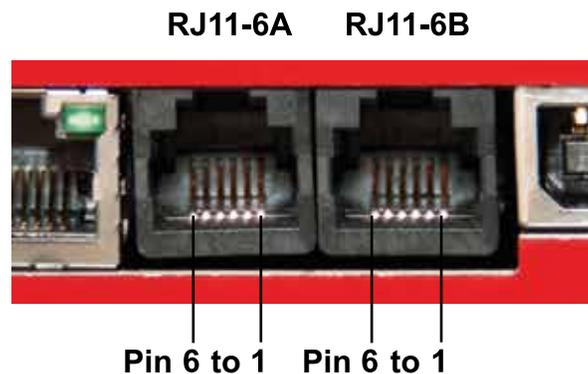
Please contact our technical department if you need other settings to be used.

1.43 RS-485 AND RS-232

Both RJ11-6A and RJ11-6B are shown below. The RS-485 signals are directly connected to the internal network. It is a gateway for the RS-485 to reach external compatible device. The second RJ11-6B also contains the same RS-485 signal plus the regular RS-232 TX and RX.

The 4 central signals are compatible on both RJ-11 connectors. It could be used as a small RS-485 hub and to deliver a small amount of power to an external device such as an EDV electronic diaphragm valve.

To ease PLC and other equipment interfacing, the IVD manages the incoming RS-232 signal and generates the direction control for the RS-485 half-duplex NETWORK. Doing that the IVD could be used as a RS-232 to RS-485 converter WITHOUT the need of extra direction control signal from the RS-232 device.

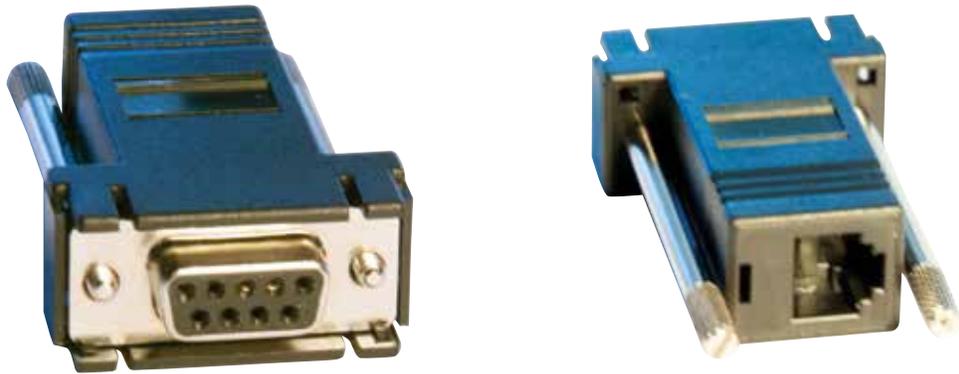


Pin	RJ11-6A	RJ11-6B	Description
1	N.C.	RX RS-232	IVD input RX
2	Power (+)	Power (+)	(12 or 24 VDC)
3	A RS-485	A RS-485	Network +
4	B RS-485	B RS-485	Network -
5	GND (-)	GND (-)	GND
6	n.c.	TX RS-232	IVD output TX

RJ11-6A and RJ11-6B connector pin description

1.44 RJ11-6B (RS-232) TO DB-9 (RS-232) ADAPTOR

This adapter is ready to use with an IVD and a regular PC serial port. The cable is completed with any reverse pin to pin RJ11-6 cable



RS-232 adaptor

1.45 USB

Fully compliant with the USB 2.0 specification, the IVD uses the Popular FTDI component (FT232RL). On recent PC, no driver need to be installed. The COM port number will be assigned by your operating system.

The Drivers for OS listed below are all available to download for free from FTDI website (www.ftdichip.com). For driver installation, please refer to

<http://www.ftdichip.com/Documents/installGuide.htm>

Windows 7 32,64-bit

Windows XP and XP 64-bit

Windows Vista and Vista 64-bit

1.46 USB TO RS-485 CABLE

To complete our communication accessories we suggest an USB to RS-485 cable adaptor from FTDI. AFP can provide this 15 feet cable terminated by a compatible RJ11-6A connector.

Many options are available to lengthen the communication cable; one of them is to use an Union adapter and a pin to pin RJ11-6 extension cable.



Cable USB to RS-485

1.47 RJ11-6 CABLE AND ADAPTOR

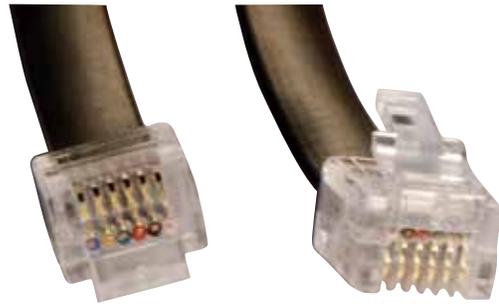
AFP settles to work with RJ11-6 pin to pin cable and adaptor. On the market those component are called “REVERSE”:

- Reverse RJ11-6 Male to RJ11-6 Male extension cable (pin1 to pin1 and so on)
- Straight Female-Female Union adaptor (pin1 to pin1 and so on)

When a user make his own cable, he has to crimp the same wire color to the same pin on EACH cable end.



Cable union adaptor



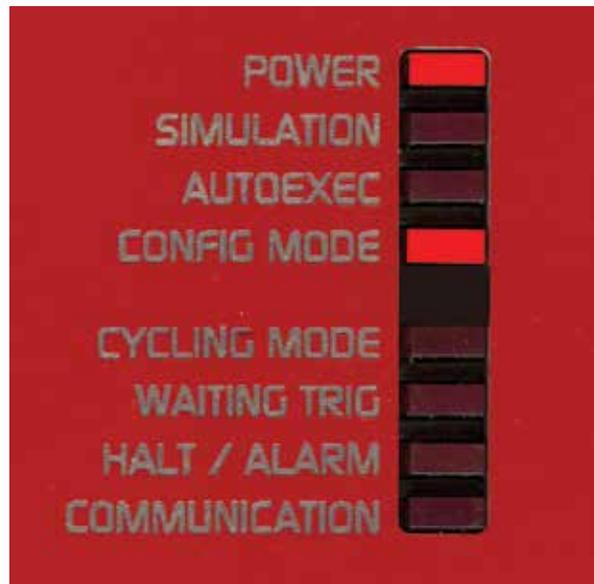
Cable Extension 10'

RJ11-6 Network Example

DESCRIPTION	AFP NUMBER	DIGI-KEY NUMBER	
Cable USB to RS-485	NO	768-1083-ND	Type-A to RJ11-6
RS-232 ADAPTOR	NO	046-0003-ND	RJ11-6 Female to DB-9 Female
CABLE EXTENSION 10'	NO	A1662R-14-ND	RJ11-6 Male to RJ11-6 Male
CABLE UNION ADAPTOR	NO	048-0056-ND	RJ11-6 Female to RJ11-6 Female

Communication cable and adaptor list

1.50 LED MODULE



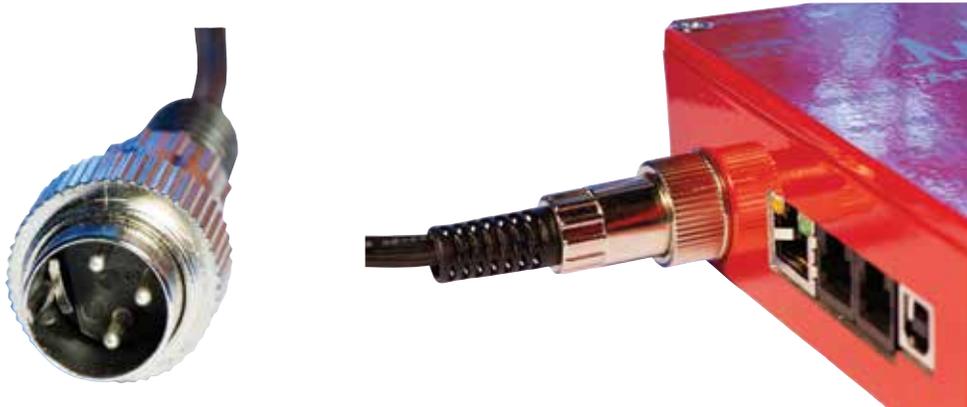
1.51 LED DESCRIPTION

When used in a time based sequence controller application, 7 LED have specific functions.

LED	DESCRIPTION	STATE	DETAIL
1	POWER		ALWAYS ON IF IVD IS POWERED
2	SIMULATION	ON	SIMULATION IN SPECIAL TRIG FUNCTION
		FLASHING	SIMULATION IN CONFIGURED INPUT ONLY
3	AUTOEXEC	OFF	CONFIGURED OFF
		ON	CONFIGURED ON
		FLASHING	ON + STOP COMMAND RECEIVED
4	CONFIG MODE	ON	WAITING FOR AN EXECUTE COMMAND
		FLASHING	EXECUTE COMMAND RECEIVED
5	CYCLING MODE	ON	STEP IN EXECUTION
		FLASHING	EXECUTING THE LAST CONFIGURED STEP IN THE SEQUENCE
6	WAITING TRIG	ON	WAITING FOR START ACTIVE INPUT
		FLASHING	WAITING FOR LOOP ACTIVE INPUT
7	HALT / ALARM	ON	SEQUENCE HALT (TIMER OFF)
		FLASHING	SEQUENCE IN ALARM AND STOPPED
8	COMMUNICATION	FLASHING	DURING COMMUNICATION
		ON	HOLD ON FOR 30 SEC. AFTER A GOOD COMMAND

1.60 POWER INLET

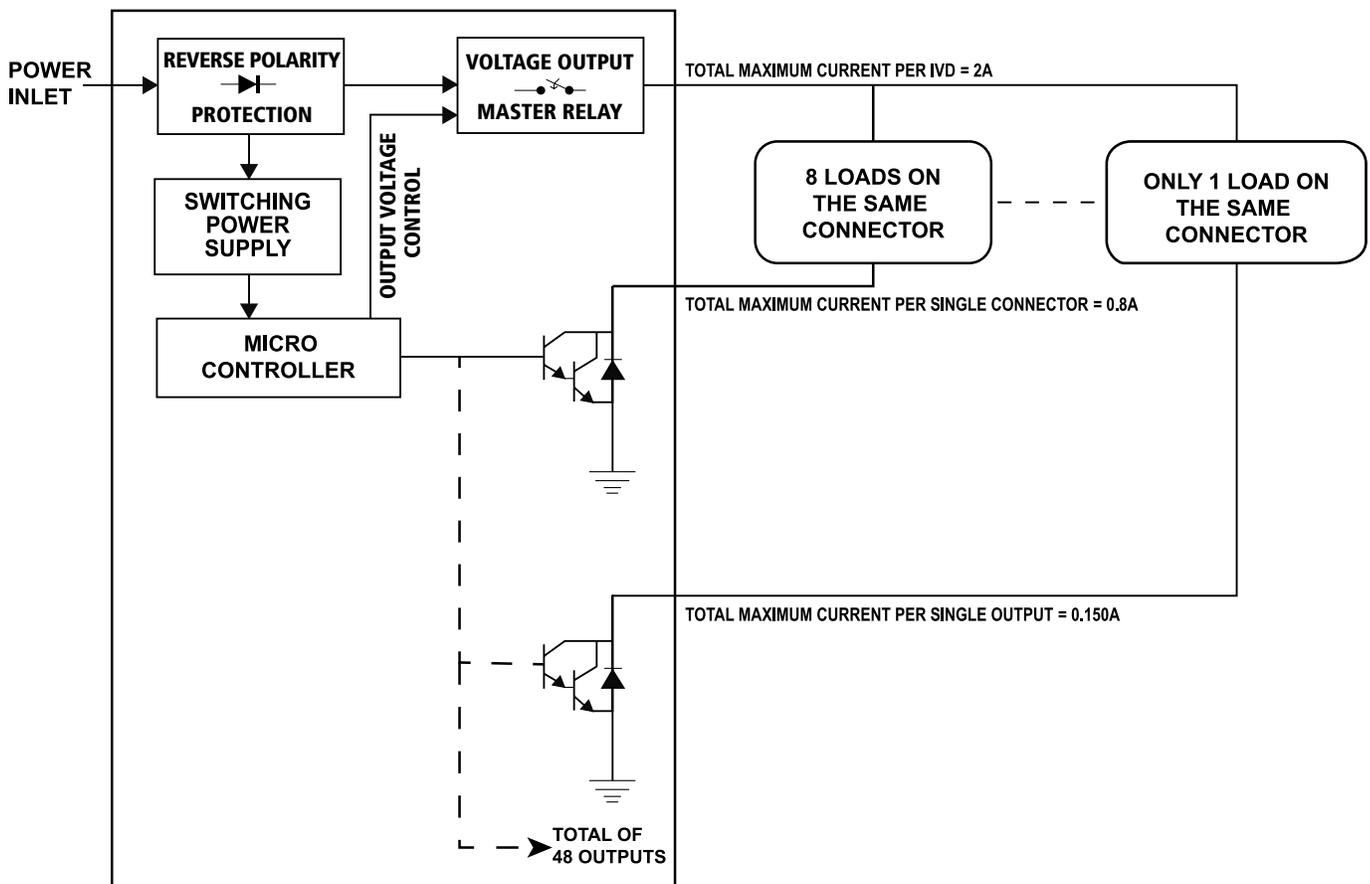
The IVD is a powerful and well protected device. The regular power input connector (locking DIN 3) lets the user provide its own power source to the IVD.



DIN 3 Male inlet connector

The reverse polarity protection and a Master Relay avoid sending wrong polarity and random signal on the output connectors that would cause malfunction and damage to external device.

Internally after the reverse polarity protection the power is split in two paths. One is regulated for the internal microcontroller operation and the second is redirected to the output connectors. The relay is activated by the microcontroller only when the output drivers are in a well-known state.



DESCRIPTIONS	DETAIL
SUPPLY INPUT VOLTAGE RANGE	8 to 24 volts DC reverse polarity protected
STANDBY CURRENT	200 mA @ 12 volts DC (2.4 WATTS)
MAX IDV OUTPUT POWER	48 Watts
MAX CONNECTOR OUTPUT POWER	19.2 Watts
MAX POWER PER OUTPUT	3.6 Watts
MALE INLET CONNECTOR	In line DIN plug locking 3 positions
MANUFACTURER NUMBER	CUI INC. Model: SD-30LP
DIGI-KEY NUMBER	CP-1033-ND

Note 1:

Even with all those protections, here are some advises to stay within the maximum IVD power dissipation. Each Driver output is very strong but the all around IVD power network has some thermal limit.

- Be careful if driving capacitive or inductive load
- Be careful if switching many outputs at the same time
- Power input must be 1.5 time the IVD MAX Power output
- Spread powerful outputs on different connectors if possible

Note 2:

Depending application and security requirements, it is good practice to add fuses or other protection device to your system.

1.70 HARDWARE INSTALLATION AND COMMUNICATION TEST

Here is a simple way to install your IVD, and test your digital inputs and outputs with a simple communication test. For this setup you need:

- Power supply with a round 3 pin connector
 - USB 2.0 cable Male Type-A to Male Type-B
 - AFP USB Installation Key.
- 1- From AFP Installation Key, execute the IVD_UTIL_INSTALL.EXE software (see section 2.10)
 - 2- Plug the external power supply to the IVD Power Inlet.
 - 3- Using a regular USB 2.0 cable (Male A to Male B), connect the IVD to your PC.

1.71 TESTING COMMUNICATION LINK

- 1- When a valid communication port is Open, most of the Main page will be enabled.
- 2- Press the Refresh button and some feedbacks should be seen.



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