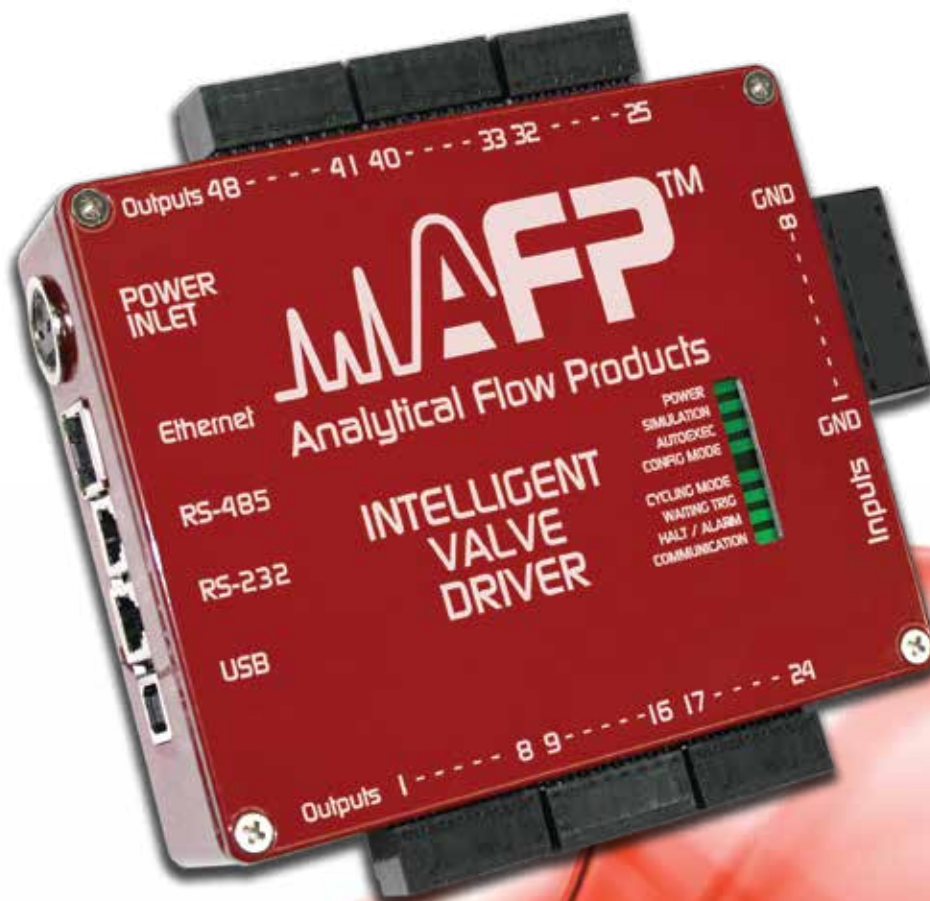




Analytical Flow Products

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# IVD : INTELLIGENT VALVE DRIVER USER MANUAL



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## CAUTIONS AND WARNINGS

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- A.** Improper installation, operation or service of this \*AFP Products™ may cause damage to the \*AFP Products™ and void the manufacturer's warranty. Tampering or unauthorized substitution of components may adversely affect the safety of this product. Repair in the event of damage: The unit should only be repaired by qualified personnel. Follow the instructions on operation and use of the unit in every respect.
- B.** Water and moisture: Never use the unit near water, for example near a bath, a wash basin, a sink, a washing machine, in a damp cellar or near a swimming pool.
- 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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### GENERAL TERMS

1. Analytical Flow Products, a division of Mécanique Analytique Inc (hereinafter referred to as "AFP"), warrants to the initial purchaser (hereinafter referred to as the "Client") the products sold by AFP (hereinafter referred to as the "Product(s)") against defects in materials or workmanship for a period of one (1) year from the date on which said Product was shipped to the Client (thereinafter referred to as the "Warranty Period").
2. In order to benefit from the present warranty, the Client must prove to the satisfaction of AFP that the Product is still within the Warranty Period.
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.
4. If the Client believes a Product to be defective, the Client must (i) immediately notify AFP of such defect in writing, (ii) cooperate fully with AFP's investigation of the alleged defect, and (iii) comply in full with all shipping and return policies established by AFP from time to time, including obtaining AFP's written approval prior to returning any Product to AFP.
5. Unless otherwise accepted in writing by AFP, all freight, shipping, brokerage, duties or other costs related to the return of Products to AFP as well as any risks of damage or loss during shipping shall be assumed by the Client.
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.

## DISCLAIMERS AND LIMITATIONS

7. THE WARRANTY DESCRIBED HEREIN IS THE ONLY WARRANTY OF ANY KIND APPLICABLE TO THE PRODUCTS AND IS EXPRESSLY GIVEN IN LIEU OF ALL OTHER WARRANTIES, INCLUDING WITHOUT LIMITATION STATUTORY, EXPRESSED OR IMPLIED WARRANTIES. NO IMPLIED WARRANTIES OF MERCHANTABILITY OR ANY WARRANTIES, WHETHER WRITTEN OR ORAL, CREATED OR EXTENDED BY ANY EMPLOYEE, DISTRIBUTOR, AGENT OR SALES REPRESENTATIVES OF AFP OR ANY WRITTEN SALES MATERIAL SHALL APPLY TO THE PRODUCTS.
8. No agent, distributor, employee or representative of AFP is allowed to make any modification, extension, or addition to this warranty whether written or verbal.
9. AFP does not control the installation and use of its Products, and shall have no liability if a Product is used for an application for which it is not suited. This warranty shall apply only to Products that have been used and maintained in accordance with the instructions provided by AFP and it shall exclude any Product installed or used other than the normal manner or purpose for which it is intended. This warranty also excludes without limitation defects or damage to Products resulting from transportation, abuse, negligence, lack of care, inappropriate storage, handling, maintenance, alterations, changes and modifications or failure resulting directly or indirectly from the use of another product not supplied by AFP, the use of accessories, items, parts or equipment not authorized by AFP, repairs not made by AFP, power surges, normal wear and tear of the Product, cosmetic damages, vandalism, theft, fire, floods and all damage caused by a fortuitous event, by superior force or by a third party.
10. The failure to pay the purchase price of the Product or the failure to comply with any of the instructions provided by AFP with regard to the Product shall automatically void this warranty.
11. Any information or data pertaining to the Products or Services, whether on AFP's website or in any information or promotional material, may contain inaccuracies and any reliance upon such information or data by Client to determine the suitable conditions of use of a given Product shall be at Client's own risk. Such information or data is presented by AFP without any representation or warranty of any kind including, but not limited to, warranties of merchantability, non infringement or fitness for any purpose.
12. Except if strictly specified in writing and signed by the client and an AFP authorized representative, AFP's Products are not recommended or authorized for safety, life support, medical applications, applications involving hazardous corrosive or radioactive substances, or for any use or application in which the failure of a component could cause substantial harm to persons, the environment, or property. Client assumes all liability for such use and agrees to indemnify and hold harmless AFP for all damages that may be incurred due to such prohibited use of the Products?
13. THIS WARRANTY SETS FORTH THE FULL SCOPE OF THE WARRANTY GIVEN BY AFP, AND AFP'S LIABILITY SHALL BE LIMITED TO THE UNDERTAKINGS SET FORTH HEREIN. UNDER NO CIRCUMSTANCES SHALL AFP OR ANY OF ITS DIRECTORS, OFFICERS, AGENTS, REPRESENTATIVES OR EMPLOYEES, OR THAT OF ANY OF ITS AFFILIATES BE LIABLE FOR ANY DIRECT, INDIRECT, SECONDARY OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER RESULTING FROM OR IN ANY WAY RELATED TO THE PRODUCTS OR THEIR USE, INCLUDING DEFECTS THEREOF. IN PARTICULAR, BUT WITHOUT LIMITATION, AFP SHALL NOT BE LIABLE FOR DAMAGES TO PROPERTY, CONSEQUENTIAL LOSS, LOSS OF PROFIT, LOSS ON GOODS IN STORE OR THE LIKE, IRRESPECTIVE OF THE CAUSE, INCLUDING CAUSES WHICH ARISE OUT OF OR CONNECTED WITH THIS WARRANTY OR FROM THE PERFORMANCE OR BREACH OF THE TERMS HEREOF, OR FROM THE TRANSPORTATION, MANUFACTURE, STORAGE, PRESERVATION, HANDLING, SALE, DELIVERY, RESALE, DISPOSAL OR USE OF ANY PRODUCT OR PART THEREOF COVERED BY THIS WARRANTY OR SOLD TO CLIENT BY AFP, NOR FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCTS, NOR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, SUCH AS, BUT NOT LIMITED TO, LOSS OF SALES, REVENUES, INCOME, GOODWILL, CONTRACTS, MATERIAL, DAMAGE TO REPUTATION OR INCREASED COSTS.

14. THE CLIENT AS WELL AS ANY SUBSEQUENT PURCHASER OR USER ASSUMES ALL THE RISKS AND FULL LIABILITY FOR ANY AND ALL LOSSES, DAMAGES, INJURIES OR DAMAGE TO ITS PROPERTY OR TO THE PROPERTY OF OTHERS IN CONNECTION WITH THE QUALITY, USE OR PERFORMANCE OF THE PRODUCT. CONSEQUENTLY, THE CLIENT HEREBY RELEASES AFP FROM ALL SUCH RISKS AND LIABILITY.
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.

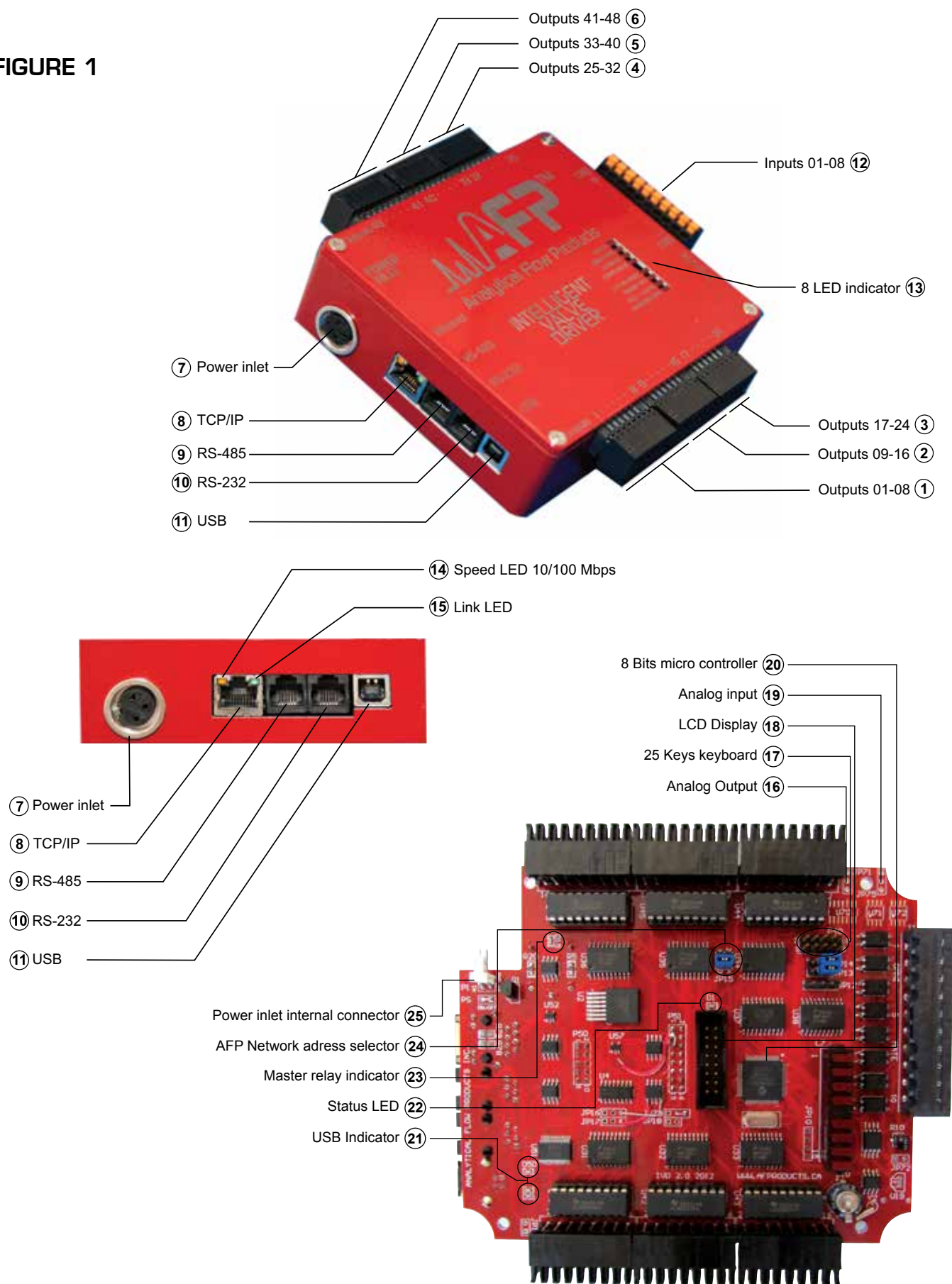
The IVD is also suited to any digital input and digital output operation. It's connector configuration and communication capability make the IVD an easy to use industrial controller.

### 1.10 GENERAL IVD SPECIFICATIONS

SPECIFICATION	DESCRIPTION		REFERENCE
8 BITS MICRO CONTROLLER	Flash program with boot loader		②①
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	①⑩
RS-485 HALF-DUPLEX	9600 Bauds	RJ11-6A	①⑨
USB 2.0 (COM PORT EMULATION)	9600 Bauds	TYPE-B	①⑪
ETHERNET 10/100 Mbps	9600 Bauds	RJ-45	①⑧
48 DIGITAL OUTPUT DRIVERS	12 /24 volts DC	6 connectors	①②③④⑤⑥
8 OPTO ISOLATED DIGITAL INPUTS	8 TO 24 volts DC	1 connector	①⑫
SUPPLY VOLTAGE MONITORING	Analog / Digital	10 Bits	
TEMPERATURE MONITORING	Analog / Digital	10 Bits	

## 1.11 IVD DESCRIPTIVE PICTURE

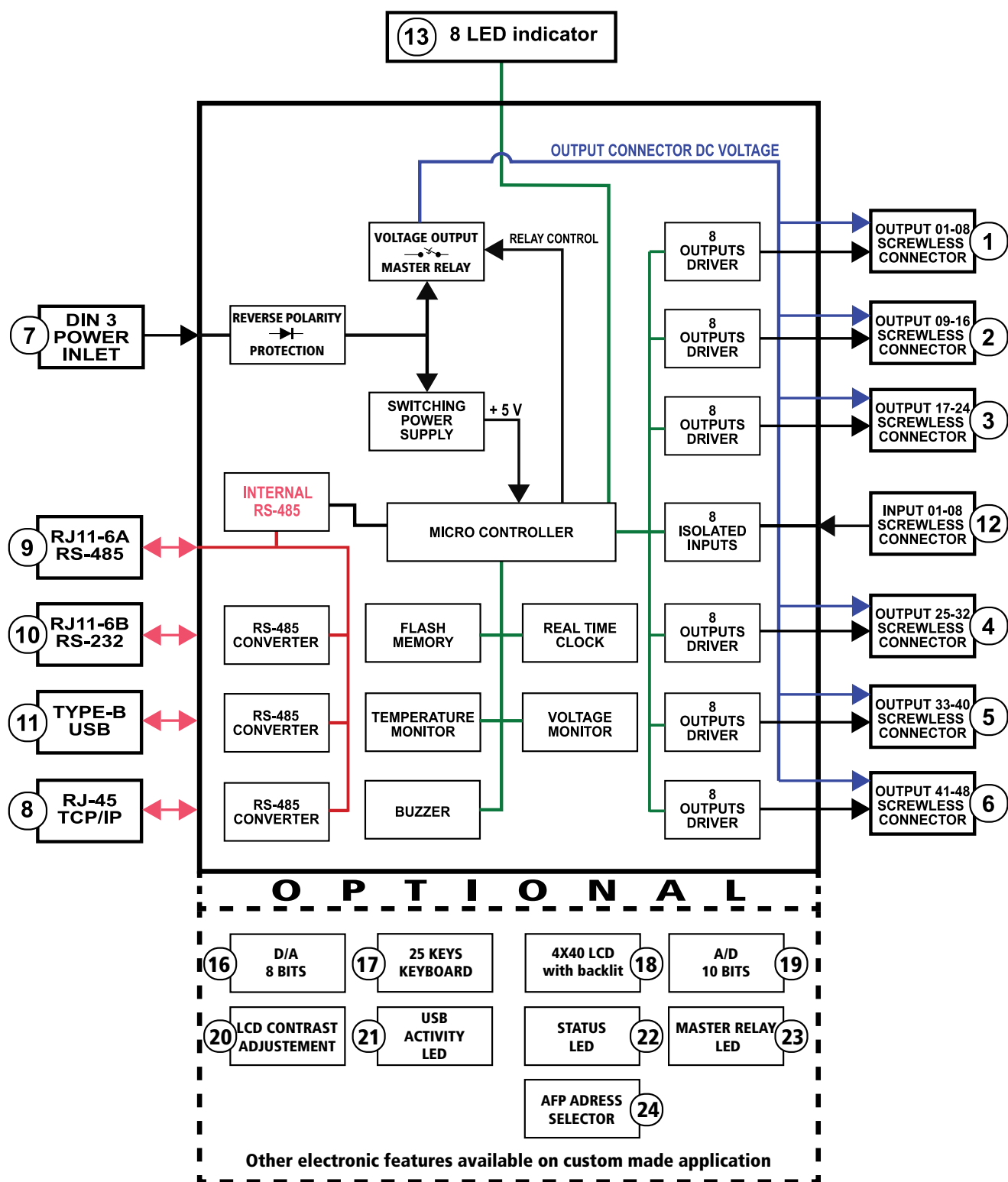
FIGURE 1



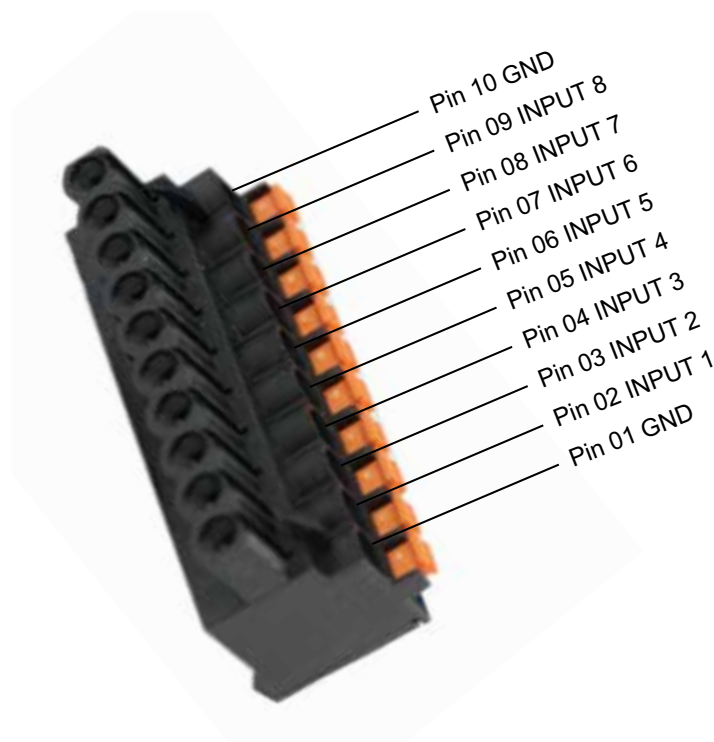


## 1.12 IVD BLOCK DIAGRAM

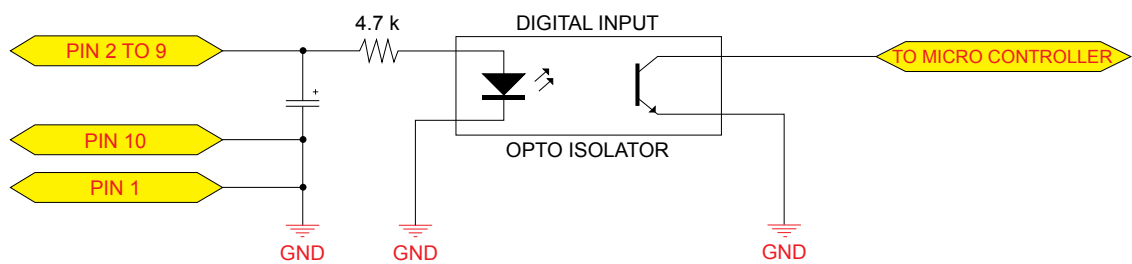
FIGURE 2



1.20 GENERAL INPUT SPECIFICATIONS

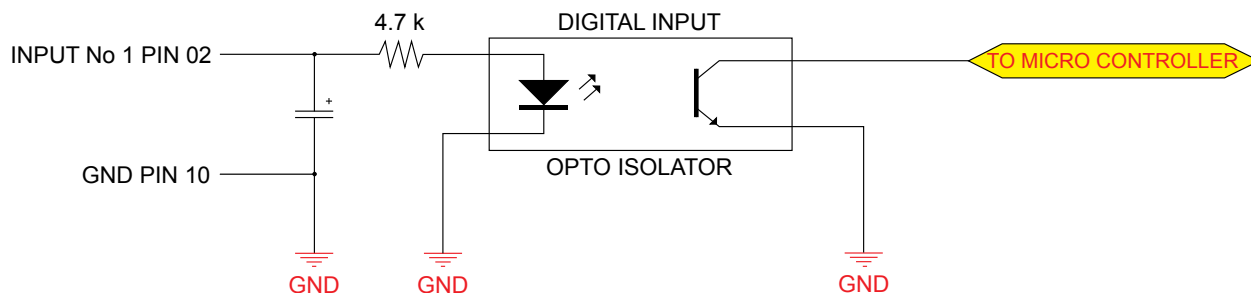


INPUT CONNECTOR



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

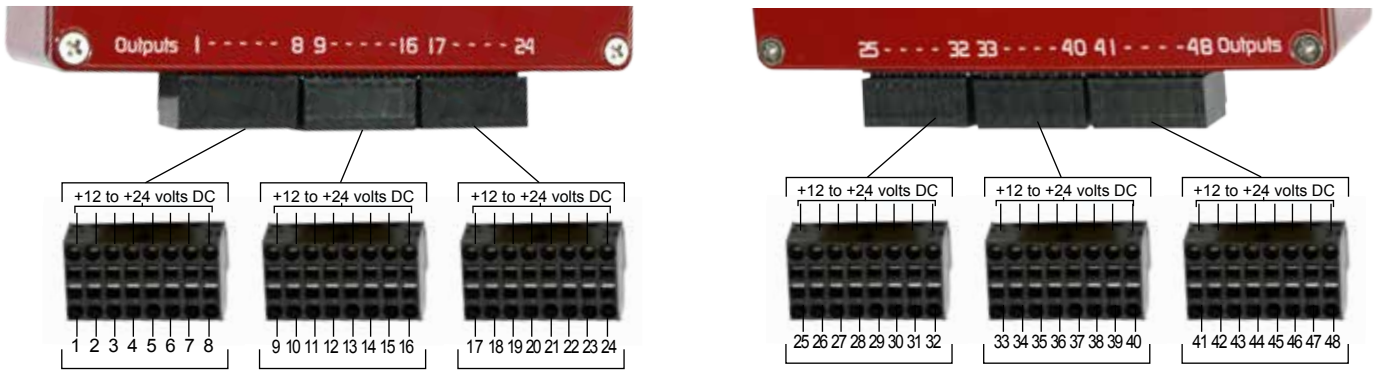


**Digital Input Typical Application**

## **1.21 DIGITAL INPUT APPLICATION**

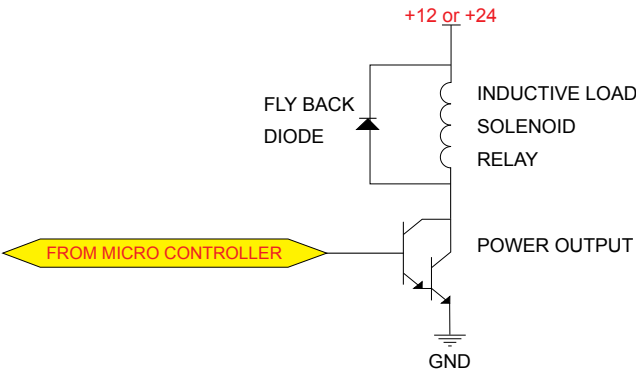
- Multipurpose digital inputs.
- Digital input could read the special trig input used in the AFP sequence program: EVD\_CONFIG
- Digital input could be used to read switch, alarm button or any other hardware equipment.
- In other application the digital input could be program to react to binary command 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

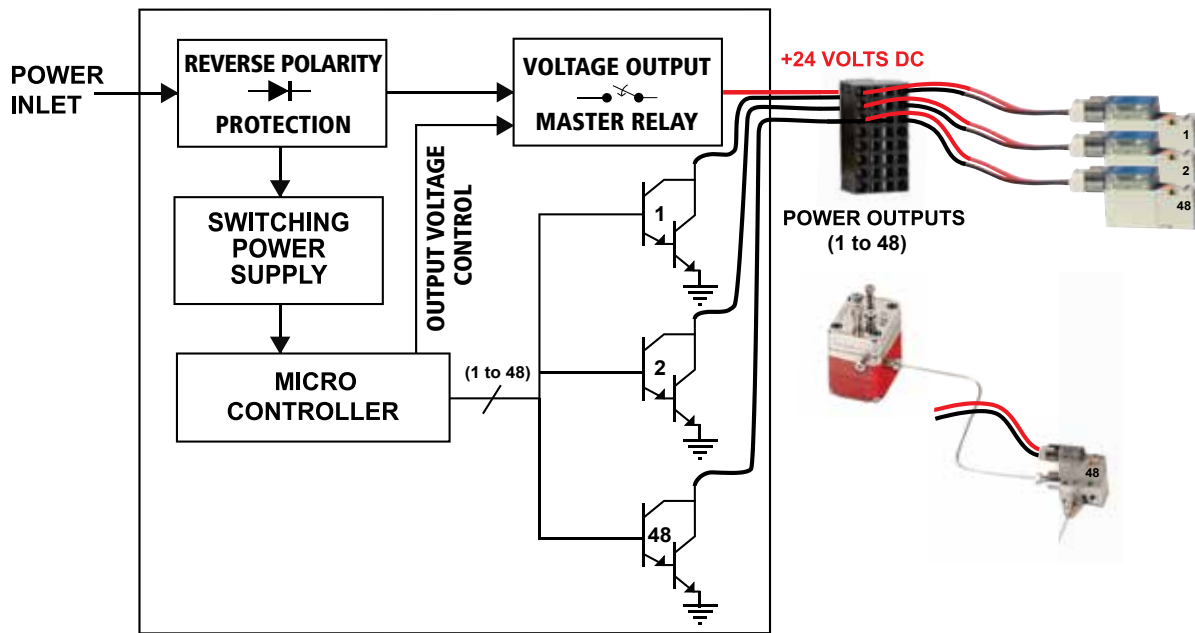
Output pin number depends on where the connector is positioned.



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

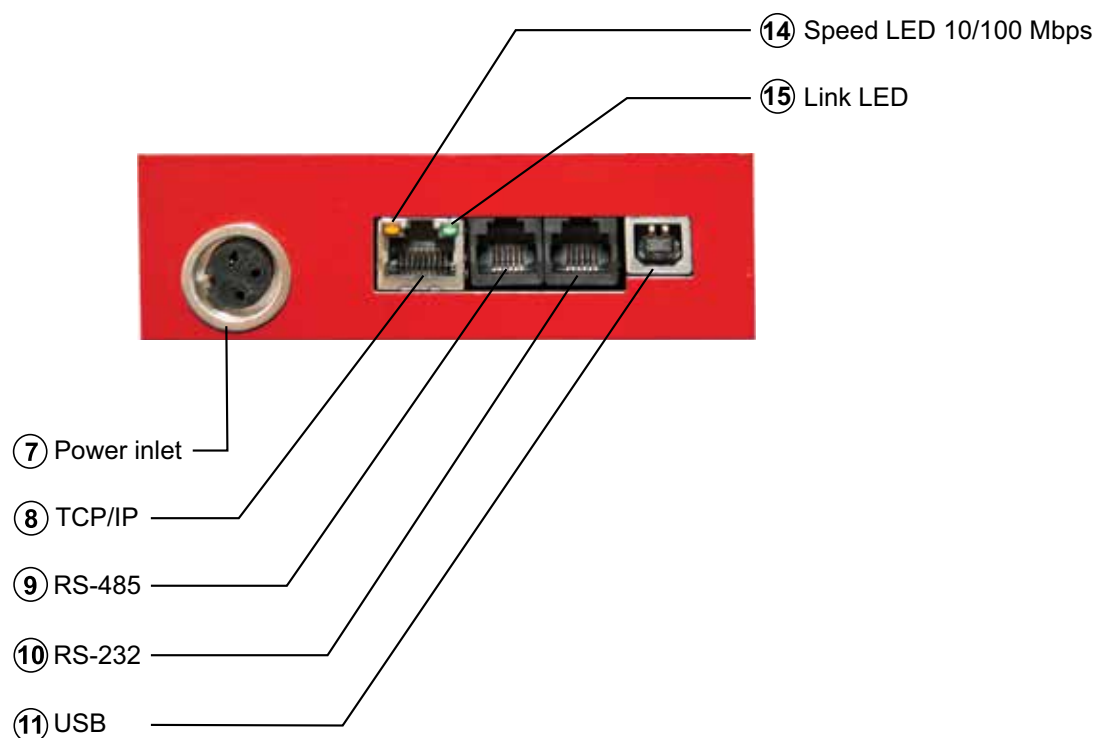
### 1.3 DIGITAL OUTPUT APPLICATION



#### 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

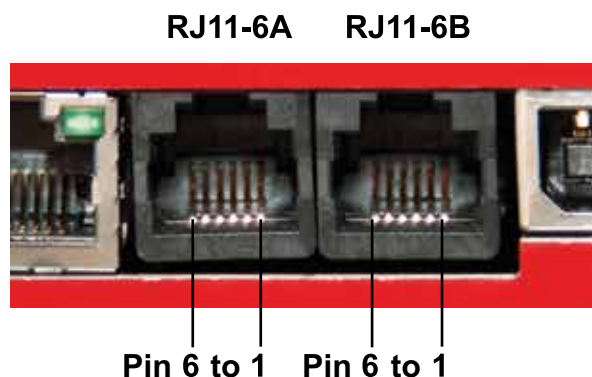
Please contact our technical department if you need other settings to be used.

## 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.

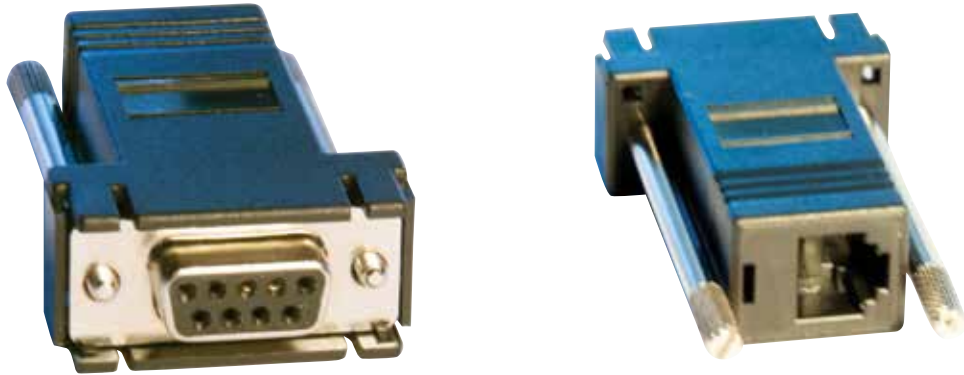


Pin	RJ11-6A	RJ11-6B	Description
<b>1</b>	N.C.	RX RS-232	IVD input RX
<b>2</b>	Power (+)	Power (+)	(12 or 24 VDC)
<b>3</b>	A RS-485	A RS-485	Network +
<b>4</b>	B RS-485	B RS-485	Network -
<b>5</b>	GND (-)	GND (-)	GND
<b>6</b>	n.c.	TX RS-232	IVD output TX

**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](http://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 extention 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**



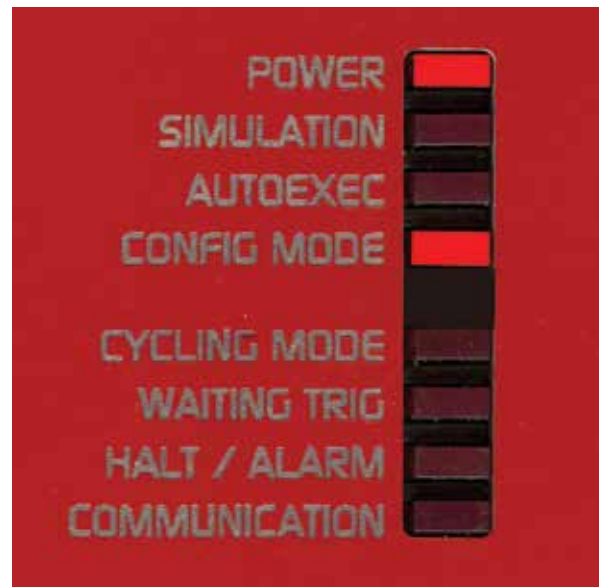
**Cable Extension 10'**

### 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



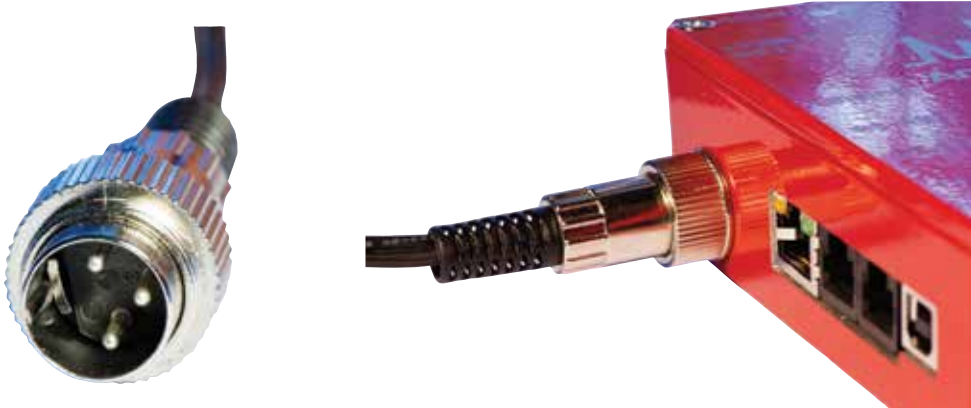
### 1.51 LED DESCRIPTION

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

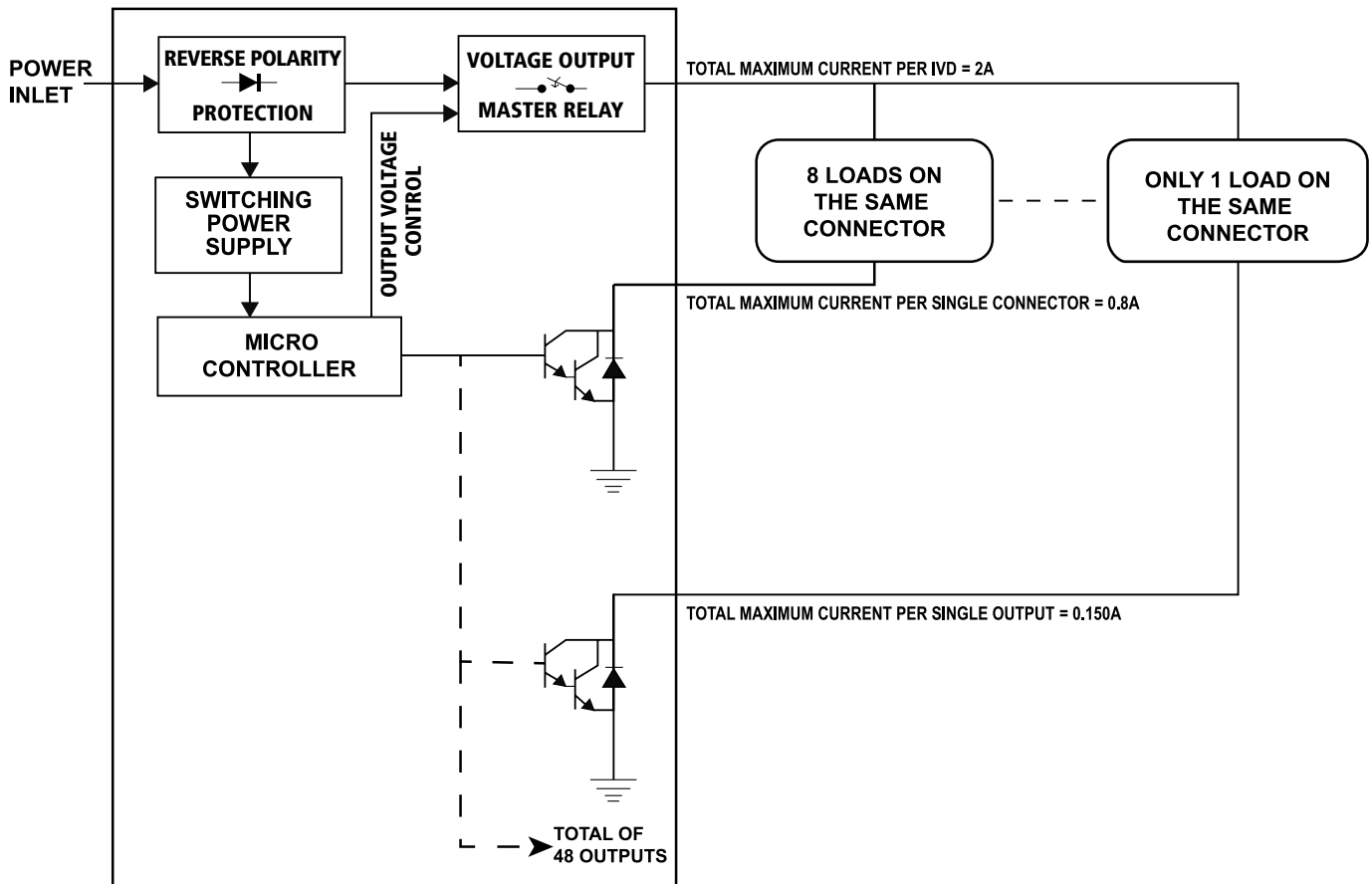
The IVD is a powerful and well protected device. The regular power input connector (locking DIN 3) lets the user provide its own power source to the IVD.



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



## NOTE



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Email: [info@afproducts.ca](mailto:info@afproducts.ca)

[www.afproducts.ca](http://www.afproducts.ca)