WESTLOCK
CONTROLS CORPORATION

Intellis

AS-i Network Monitor
Model 7704, 7744 & 7779

Installation and Operation Manual

Revision History

Revision 1.0
4 April 2002
Initial Version

Revision 1.1
22 November 2004
Document was updated to reflect new PCB design, addition of pneumatic section, misc. corrections and changes in IOM format.

1 Introduction

1.1 Scope of Manual

This manual contains installation, configuration and specification data for the AS-iPAC AS-i valve controller.
This manual assumes a basic level of familiarity and competence with AS-i terminology and technology. Only qualified personnel should install, operate and maintain this equipment.

1.2 Symbols Used in this Document

This symbol warns the user of possible danger. Failure to heed this warning may lead to personal injury or death and/or severe damage to equipment.

This symbol identifies information about operating the equipment in a particular manner that may damage it or result in a system failure. Failure to heed this warning can lead to total failure of the equipment or any other connected equipment.

This symbol draws attention to information that is essential for understanding the operation and/or features of the equipment.

1.3 About AS-interface

AS-i is an easy to use, low-cost, network solution that has been designed specifically for use in low level automation systems. AS-i is a digital replacement for traditional parallel wiring that is easy to install, simple to configure, operate and maintain. AS-i technology is highly flexible in its topology and is compatible with many fieldbus or device networks. Low-cost gateways exist to use AS-i with Modbus, Modbus +, DeviceNet, PROFIBUS, Ethernet, Interbus, FIP, LON, RS-485,RS-422 and RS232.
AS-International, the sponsor organization of AS-i, was formed in 1991 by a consortium of 11 European companies who developed the standard. Today, this association is open to any manufacturer or user of this technology and boasts a membership of nearly 100 companies worldwide,

offering over 600 products and services. The North American Chapter, the AS-i Trade Organization (ATO), was formed in April of 1996. Through the ATO, members can submit AS-i products for conformance testing and certification.
Westlock Controls is a member of the ATO and our AS-I products are conformance tested and certified.

1.4 Westlock Intellis AS-i 2.1 Module EL-40091

The AS-i Pneumatic Actuator Controller (APAC) EL-40091 module is a four input, two output network monitor with default slave profile S-7/A, (S-I/O code/ID code). Inputs 0 and 1 are internal Hall Effect sensors that are activated by the shaft trigger assembly magnets (South Pole). Inputs 2 and 3 are active low (activated by pulling the input to ground) for use with dry contact type sensors. Outputs are FET (field effect transistor) open drain active low with diode and short circuit protection.
The module consumes 45 mA of current with both inputs and one output active driving a standard NI Falcon solenoid (20mA non-incendive solenoid coil). Minimum power supply input voltage is 19 Vdc to assure proper communications.
Connection to the network is via the single unshielded two-wire cable that supplies power, nominal 30 Vdc, and signal. The sensors and actuator are connected to the AS-i cable via the AS-i slave chip.
In the Extended Address Mode 62 slaves can be used on one network. The address range is still 1-31 but each slave is assigned as an “A” slave or a “B” slave. The fourth output data bit of the slave is used to identify whether a slave is an “A” slave or a “B” slave.
In each scan cycle, 3 output data bits plus one address selector bit (“A” slave or “B” slave indication) are transferred serially to each slave from the master and 4 input data bits are returned to master by each slave. In a full configuration with 62 slaves the scan cycle time is 10 ms. For a network with 31 slaves the scan cycle time is 5 ms. Scanning is deterministic.
For data exchange to occur, each network monitor connected to the AS-i network must be programmed with an unique address, numbered between 1-31 “A” and 1-31 “B” for Extended Address Mode. This may be accomplished via a handheld programmer or directly through the master. The address, which can be changed at any time, is stored internally in an EEPROM.

Note: To utilize the extended addressing mode an AS-i Specification rev.2.1 master must be used.

1.4.1 Module Bit Map

Table 1			
I/O	**TYPE**	**MODULE REFERENCE**	**BITMAP OF DATA**
Input 0	Active High/Low[1]	Closed, Bottom Limit Sensor	Byte 0, Bit 0
Input 1	Active High/Low[1]	Open, Upper Limit Sensor	Byte 0, Bit 1
Input 2	Active High/Low[1]	Auxiliary Input 1	Byte 0, Bit 2
Input 3	Active High/Low[1]	Auxiliary Input 2	Byte 0, Bit 3
Output 0	Active Low[2]	OUT_0 to Solenoid A	Byte 0, Bit 0
Output 1	Active Low[2]	OUT_1 to Solenoid B or Auxiliary Output	Byte 0, Bit 1
[1] Active High indicates that pulling the input pin up to V+ activates the input. Active Low indicates that pulling the input pin down to ground activates the input. 2 Active Low indicates that the output is an open collector type circuit.			

1.4.2 Watchdog Timer

The AS-i processor has an embedded watchdog timer that is enabled in the EL-40091 Module. The watchdog timer will be activated for any slave address after the reception of a Write_Parameter Request. It will be de-activated by any circuit reset and after the reception of a Delete_Address Request.When activated, the watchdog timer will be reset by every Write_Parameter and Data_Exchange Request received by the slave. If no such request is receive by the slave within 40 ms, a hardware reset will be performed by the slave and Outputs will be switched inactive de-energizing any attached solenoids.

1.4.3 LED Status Indicators

The LEDs provide information concerning the status of inputs, outputs, the module and/or the network. The LEDs provide visual indication whether any inputs or outputs are active and whether the module or network is in a fault condition. The I/O Status LEDs are intended to indicate the state of the inputs and outputs.

Table 2			
Module p/n	**LED**	**Condition**	**Indicates**
EL-40091 Refer to Figure 1	D5	Yellow	Input 0, Bottom L.S. Closed, Valve Closed
	D6	Yellow	Input 1, Top L.S. Closed, Valve Open
	D8	Green	Network power available to module/module energized
	D10	Red	Output 0 Energized, Solenoid "A"
	D12	Red	**Solid Red**- No Data Exchange Fault Indication- Possible causes are Master is in STOP mode, slave has zero address, slave has an address not in the LPS, slave has an incorrect IO/ID-configuration or the slave has detected an internal hardware fault. *HW outputs will be de-energized.* **Blinking Red**- Periphery Fault Indication

1.4.4 Module Layout

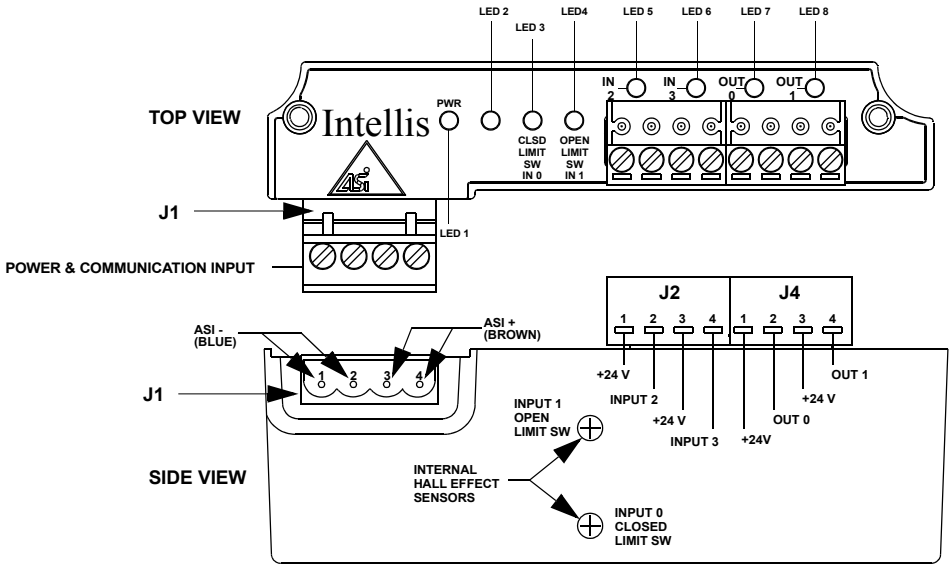


Figure 1 - EL-40091

1.5 Device Specifications

1.5.1 Specifications

Slave Profile	Spec. 2.1 S-7/A (S-I/O code/ID code)
Medium	Unshielded 2-wire cable for data and power (24VDC/typically up to 8A for connected devices)
Length of bus cable	100m for single cable; extendable up to 300m using repeaters
Number of slaves	31 max (in standard address mode), 62 max (in extended address mode)
I/O count	In standard address mode up to 4 inputs and 2 outputs per slave (max 248 in + 124 out = max 372 I/O).
Addresses	Each slave has a defined address. Address is set by the master or by a hand-held programmer. Address range is 1-31 "A" slave or "B" slave selected in extended address mode (0 = slave unused).
Bit-rate	4 bits (net) per slave and message
Cycle time with 31/62 slaves	5mS/10mS @ 167 kbd
Encoding method	Manchester Encoding
Process data in the master	Cyclic polling of all participants
Master services	Initialization of the network, identification of participants and acyclic setting of parameter values to the slaves

1.5.2 Current Consumption

Table 3

	Current Consumption @ 24 Vdc
Module Only	20 mA
Module + NI[1] Falcon	40 mA
Module + (2) NI[1] Falcon	60 mA
Module + XP[2] Falcon	45 mA
Module + (2) XP[2] Falcon	70 mA

[1]Non-incendive Falcon coil

[2]Explosion Proof Falcon coil

2 Installation Instructions

Note IMPORTANT: If the valve monitor is already in the field mounted on an actuator and valve, please follow the field wiring instructions in Section 2.3.

Warning Confirm that the area is known to be non-hazardous before opening the cover of a network monitor and making or breaking any electrical connections.

2.1 Mounting

For steps 1-3 refer to Figure 2 below.

1. Attach the proper mounting bracket and adapter (if required) to the valve monitor housing with the hardware provided.
2. Operate the actuator to full closed position.
3. Attach the valve monitor and mounting bracket to the actuator.

4. Note the position of the actuator/valve and confirm the Beacon position is properly aligned, as shown in Figure 3 below while replacing the cover.

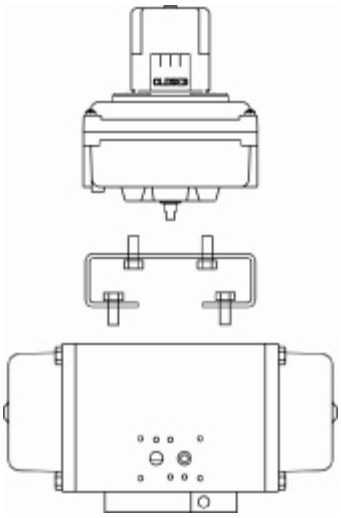


Figure 2

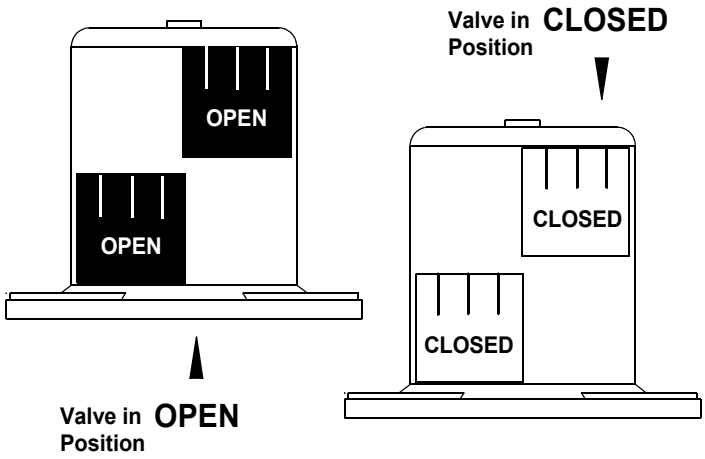


Figure 3

2.2 Pneumatic Connections

Personal injury and/or property damage may occur from loss of process control if the supply medium is not clean, dry oil-free air or non-corrosive gas. Instrument quality air that meets the requirements of ISA Standard S7.3-1975 is recommended for use with pneumatic equipment in process control environments. Westlock Controls recommends the use of a 20 micron filter with all Falcon solenoids.

2.2.1 Tubing and Fittings

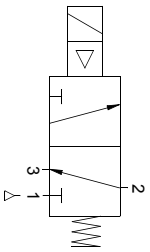
The use of copper, stainless steel, nylon or polyethylene tube is recommended for piping up air circuits and equipment. As a general rule, pipe threaded fittings should not be assembled to a specific torque because the torque required for a reliable joint varies with thread quality, port and fitting materials, sealant used, and other factors. The suggested method of assembling pipe threaded connections is to assemble them finger tight and then wrench tighten further to a specified number of turns from finger tight. The assembly procedure given below is for reference only; the fitting should not be over tightened for this will lead to distortion and most likely, complete valve failure.

1. Inspect port and connectors to ensure that the threads on both are free of dirt, burrs and excessive nicks.

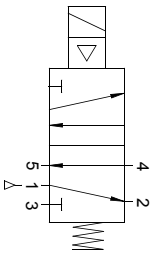
2. Apply sealant/lubricant or Teflon tape to the male pipe threads. With any sealant tape, the first one or two threads should be left uncovered to avoid system contamination.
3. Screw the connector into the port to the finger tight position.
4. Wrench tighten the connector approximately 1 - 2 turns (to seal) from finger tight. Again this is only reference - the fitting should **NOT** be over tightened.

Note Delrin valve bodies are fitted with hellicoils therefore an extra effort should be made **NOT** to over tighten pipe fittings or retaining screws (.5 - 1 turns from finger tight to seal). Over tightening will result in valve failure or pull hellicoils from valve body.

2.2.2 Porting



(Air Line) Designation
1/4" NPT air ports for inlet, outlet, and exhaust
(3.5 Cv valve has 1/2" NPT air ports)



Spring Return Valve

Description of Operation: Solenoid De-energized - air flows from Outlet Port 2 to Exhaust Port 3. Solenoid Energized - air flows from Inlet Port 1 to Outlet Port 2.

Spring Return Valve

Description of Operation: Solenoid De-energized - air flows from Inlet Port 1 to Outlet Port 2 and exhausts from Port 4 to Port 5. Solenoid Energized - air flows from Inlet Port 1 to Outlet Port 4 and exhausts from Port 2 to Port 3.

Figure 4

2.2.3 Maintenance

Routine maintenance is usually confined to the periodic replenishment of Dow Corning III lubricant or equivalent to spool and spring.

2.3 Switch Adjustment

Note Switches are factory set. If you need to adjust switches for any reason follow instructions below.

For steps 1-8 refer to Figures 1 and 5.

1. Refer to Figure 1 and note the approximate locations of the Open and Close targets on the APAC module.
2. With the valve in the closed position, lift bottom cam of the Close sensor trigger.
3. Turn cam until face of trigger is perpendicular to the target and sensor is activated as evidenced by the lighting of the corresponding module LED.
4. Release the cam and the spring will push cam back onto the splined shaft.
5. Operate the actuator to the opened position.
6. Push down the top cam of the Open sensor trigger.
7. Turn cam until face of trigger is perpendicular to the target and sensor is activated as evidenced by the lighting of the corresponding module LED.
8. Operate actuator from one extreme to the other several times to check Limit Sensor operation.

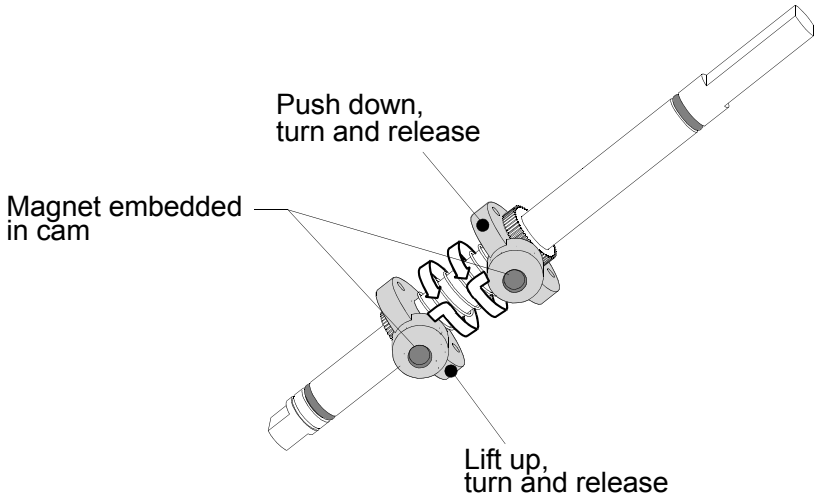


Figure 5

2.4 Wiring Instructions

All wiring must be in accordance with National Electrical Code (ANSI-NFPA-70) for the appropriate area classifications.

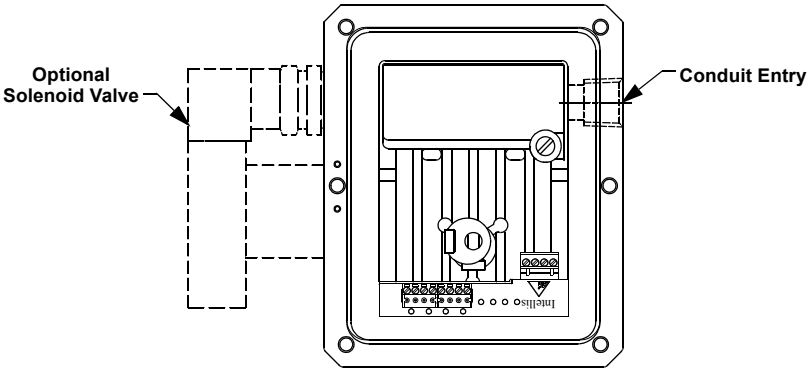
All wiring must be in accordance with National Electrical Code (ANSI-NFPA-70) for area classifications. The valve monitors are approved as nonincendive for Class I, Division 2, Groups A,B,C and D; dust-ignition proof for Class II/III, Division 1, Groups E,F and G hazardous (classified) locations; indoor/outdoor (NEMA type 4, 4X).

Always check the nameplate to make sure the agency approval ratings coincide with the application.

The proper wiring diagram for your unit is shown on the inside of the enclosure cover.

1. Wiring options for 7704, 7744 and 7779 are shown in Figures 6 and 7 below.
2. Replace the electronics housing cover or junction housing cover.
3. Unit is now ready for automatic operation. If any assistance is required, please call Westlock Controls at (201) 794-7650.

Model # 7779



Model # 7704/7744

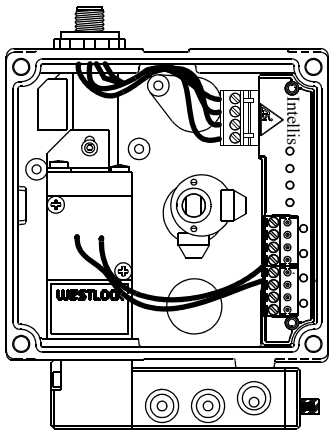
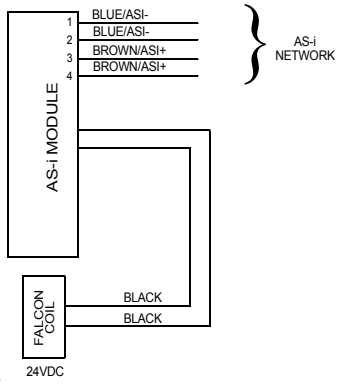


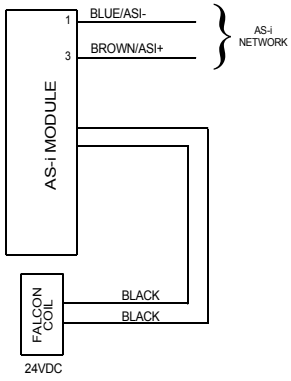
Figure 6

Wiring for Zero-Drop/Daisy Chain Topology



Note:
Refer to identification label of the unit(s) and/or solenoid valve for electrical parameters.

Wiring for Trunk/Drop Topology



Note:
Refer to identification label of the unit(s) and/or solenoid valve for electrical parameters.

Figure 7

2.4.1 APAC Connector Pin-out Diagrams

Pin 1/ ASI-/Blue
Pin 2/ ASI-/Blue
Pin 3/ ASI+/Brown
Pin 4/ ASI+/Brown

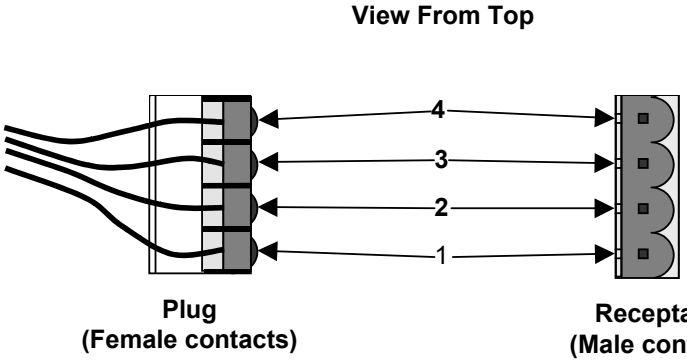


Figure 1
4-Pin Open Connector

Pin 1/ ASI+/Brown
Pin 2/ NC
Pin 3/ ASI-/Blue
Pin 4/ NC

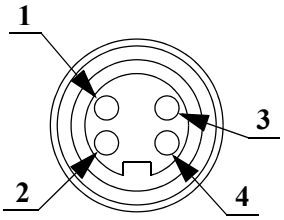


Figure 2
4-PIN
"MINI" CONNECTOR
FEMALE

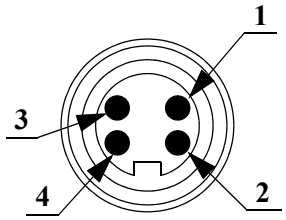


Figure 3
4-PIN
"MINI" MALE
FIELD WIREABLE

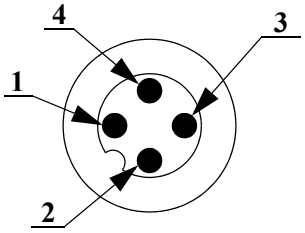


Figure 4
4-PIN
M12 MALE
"MICRO" CONNECTOR

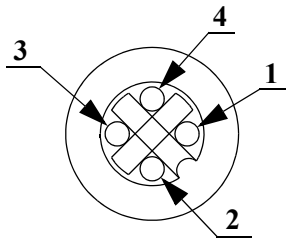
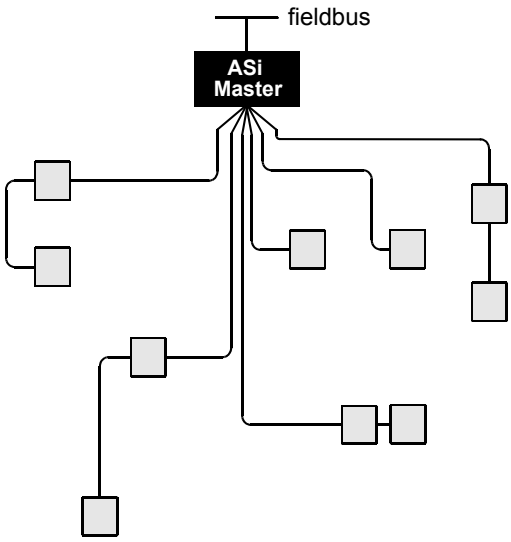


Figure 5
4-PIN
M12 FEMALE
"MICRO" CONNECTOR

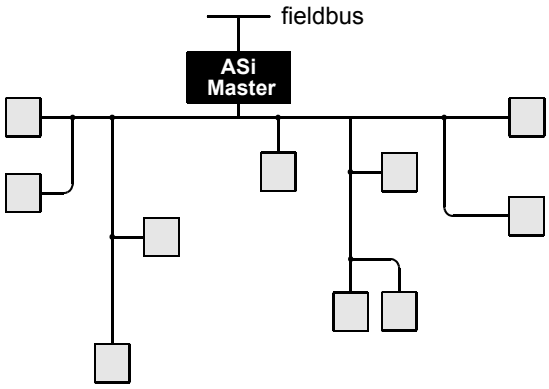
2.5 AS-i Supported Topologies

Note Total cable length is not to exceed 100m without the use of repeaters, extenders or tuners.

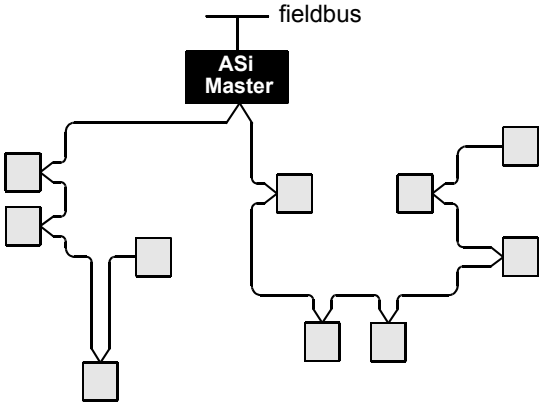
Star



Trunk/Drop



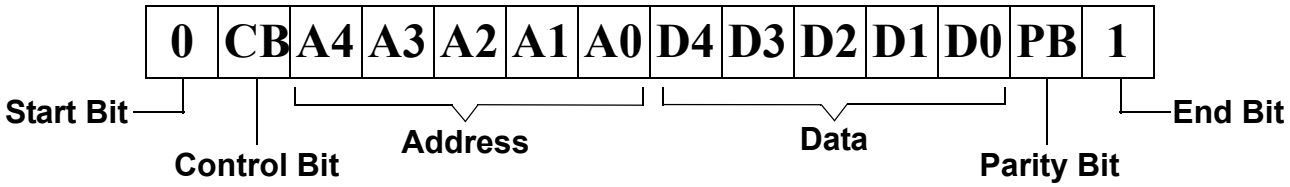
Zero Drop/Daisy Chain



3 AS-i Communications Overview

3.1 AS-i Message Framing

The AS-i master message frame is always 14 bits in length, including 10 user bits.



The master cyclically queries (Polling) each slave in sequence, each slave being identified by its own unique address.

The As-i slave response if always 7 bits in length, including 4 user bits for input status.

There are 4 bits of input data and 4 bits of output data in stndard address mode or 3 bits of output data in extended address mode of output data produced and consumed by the slave. Slave input and output data are mapped to the master as follows.

Bit 0 (1=Active)	**Output #1**	**Input #1**
Bit 1 (1=Active)	**Output #2**	**Input #2**
Bit 2 (1=Active)	**Output #3**	**Input #3**
Bit 3 (1=Active)	**Output #4 or "A" slave "B" slave** select bit in extended address mode	**Input #4**

3.1.1 AS-i Master Output Bit Map

There are 4 bits of input data and 4 bits of output data produced and consumed by the slave. Slave input and output data are mapped to the master as folows.Protected

AS-i Master Output Bit-Map

Byte	Bits 7,6,5,4	Bits 3,2,1,0
0	Slave 1 or 1A	Flags
1	Slave 3 or 3A	Slave 2 or 2A
2	Slave 5 or 5A	Slave 4 or 4A
3	Slave 7 or 7A	Slave 6 or 6A
4	Slave 9 or 9A	Slave 8 or 8A
5	Slave 11 or 11A	Slave 10 or 10A
6	Slave 13 or 13A	Slave 12 or 11A
7	Slave 15 or 15A	Slave 14 or 14A
8	Slave 17 or 17A	Slave 16 or 16A
9	Slave 19 or 19A	Slave 18 or 18A
10	Slave 21 or 21A	Slave 20 or 20A
11	Slave 23 or 23A	Slave 22 or 22A
12	Slave 25 or 25A	Slave 24 or 24A
13	Slave 27 or 27A	Slave 26 or 26A
14	Slave 29 or 29A	Slave 28 or 28A
15	Slave 31 or 31A	Slave 30 or 30A

Byte	Bits 7,6,5,4	Bits 3,2,1,0
16	Slave 1B	Flags
17	Slave 3B	Slave 2B
18	Slave 5B	Slave 4B
19	Slave 7B	Slave 6B
20	Slave 9B	Slave 8B
21	Slave 11B	Slave 10B
22	Slave 13B	Slave 12B
23	Slave 15B	Slave 14B
24	Slave 17B	Slave 16B
25	Slave 19B	Slave 18B
26	Slave 21B	Slave 20B
27	Slave 23B	Slave 22B
28	Slave 25B	Slave 24B
29	Slave 27B	Slave 26B
30	Slave 29B	Slave 28B
31	Slave 31B	Slave 30B

Flags

Bit 3	Protected Mode
Bit 2	Configuration Mode
Bit 1	Auto-Address Enable
Bit 0	Off-Line

3.1.2 AS-i Master Input Bit Map

AS-i Master Input Bit-Map

Byte	Bits 7,6,5,4	Bits 3,2,1,0
0	Slave 1 or 1A	Flags
1	Slave 3 or 3A	Slave 2 or 2A
2	Slave 5 or 5A	Slave 4 or 4A
3	Slave 7 or 7A	Slave 6 or 6A
4	Slave 9 or 9A	Slave 8 or 8A
5	Slave 11 or 11A	Slave 10 or 10A
6	Slave 13 or 13A	Slave 12 or 11A
7	Slave 15 or 15A	Slave 14 or 14A
8	Slave 17 or 17A	Slave 16 or 16A
9	Slave 19 or 19A	Slave 18 or 18A
10	Slave 21 or 21A	Slave 20 or 20A
11	Slave 23 or 23A	Slave 22 or 22A
12	Slave 25 or 25A	Slave 24 or 24A
13	Slave 27 or 27A	Slave 26 or 26A
14	Slave 29 or 29A	Slave 28 or 28A
15	Slave 31 or 31A	Slave 30 or 30A

Byte	Bits 7,6,5,4	Bits 3,2,1,0
16	Slave 1B	Flags
17	Slave 3B	Slave 2B
18	Slave 5B	Slave 4B
19	Slave 7B	Slave 6B
20	Slave 9B	Slave 8B
21	Slave 11B	Slave 10B
22	Slave 13B	Slave 12B
23	Slave 15B	Slave 14B
24	Slave 17B	Slave 16B
25	Slave 19B	Slave 18B
26	Slave 21B	Slave 20B
27	Slave 23B	Slave 22B
28	Slave 25B	Slave 24B
29	Slave 27B	Slave 26B
30	Slave 29B	Slave 28B
31	Slave 31B	Slave 30B

Flags

Bit 3	Configuration Mode on Gateway Active
Bit 2	Normal Operation Active
Bit 1	“APF” AS-i Power failure
Bit 0	Configuration OK

Appendix A

Contact Information

USA

Westlock Controls Corp.
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Sao Paulo, CEP 06465-130
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