

HALEN SYSTEM USER MANUAL



Version 2.00

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Introduction

The HALEN System is a general-purpose Allen-Bradley based measurement & control panel. The Halen system provides 136 channels for industrial measurement and control applications.

The HALEN system features a 17- slot ControlLogix PLC inside. This PLC can be programmed using the [Studio 5000 Logix Designer software](#) from Rockwell Software®.

Interfacing connectors include (x2) Cat6a RJ45 inline coupling connectors for Ethernet TCP/IP interfacing. These ports allow for interfacing with the ControlLogix PLC and the Allen Bradley 5-port ethernet switch (1783-US5T). These ports can be used to allow the HALEN system to be linked in series with other systems creating a smart distributed control network.

The HALEN system features both a 180W and a 480W 24VDC power supplies. This allows the HALEN system to supply a total of 16A of 24VDC power over 16 different channels (1A/point). The HALEN system features individually fused channels for short-circuit protection. Power input to the HALEN system is a wide range 100VAC-240VAC input (45 – 65Hz) (9A max consumption at 115VAC Nominal).

The HALEN system features (x11) IP68 metal cable clamps (glands) for fast and secure I/O installation.

For inquiries or technical support please contact us directly at info@valkyriecontrols.com

Technical Specifications

The HALEN System's technical specifications may vary from version to version. The HALEN System's specifications are listed in the following table. The following specifications are for the range of 0 °C to 60 °C unless otherwise noted.

Table 1. HALEN System's Technical Specifications

Digital Inputs	(x32) 24VDC Fused Sinking Inputs
Digital Outputs	(x32) 24VDC Fused Sourcing Outputs (x16) Fused 24VDC Powered Outputs Rated for 1A/point
Analog Inputs	(x16) Voltage/Current Analog Inputs with HART
Analog Outputs	(x16) Voltage/Current Analog Outputs with HART
RTD Input	(x16) Isolated 3- and 4- Wire RTD Inputs
Dry Contact	(x8) 10-240 VAC/5-125 VDC Isolated Contacts
Ethernet Connectivity	(x2) RJ45 GbE (Cat6a)
Power Input	100VAC-240VAC Wide Range Input 45 – 65Hz;
PLC Configuration	(x1) 17-Slot Standard Series B ControlLogix Chassis; 1756-A17/B (x1) 24VDC Standard Power Supply; 1756-PB75/B (x1) Allen Bradley ControlLogix 5580 Controller; 1756-L83E (x2) 16-ch Digital Input Module; 1756-IB16 (x2) 16-ch Digital Output Module; 1756-OB16D

	(x2) 8-ch Voltage/Current Analog Input Module with HART; 1756-IF8H
	(x2) 8-ch Voltage/Current Analog Output Module with HART; 1756-OF8H
	(x2) 8-ch Isolated RTD/Thermocouple Analog Input Module; 1756-IRT8I
	(x1) 16-ch AC/DC Isolated Contact Module; 1756-0W16I
	(x1) 8-ch AC/DC Isolated Contact Module; 1756-OX8I
	(x4) ControlLogix Slot Filler Module; 1756-N2
Expandability	(x4) Spare PLC Slots
Operating Temperature	+32 to 113 °F (0 to 45 °C)
Storage Temperature	+5 to 140 °F (-15 to 60 °C)
Physical Dimensions	60" x 36" x 12"
I/O Interface	Weidmuller Terminal Blocks (Metal Gland Access)
Power Supplies	Weidmuller 24VDC DIN Rail Power Supplies; 1478120000 and 1478140000

Hardware List

(x1) 17-Slot Standard Series B
ControlLogix Chassis; 1756-A17/B



(x1) 24VDC Standard Power
Supply; 1756-PB75/B



(x1) Allen Bradley ControlLogix 5580
Controller; 1756-L83E



(x2) Allen Bradley ControlLogix 16-
Channel Digital Input Module; 1756-IB16



(x2) Allen Bradley ControlLogix 16-
Channel Digital Output Module: 1756-
OB16D



(x2) Allen Bradley ControlLogix 8-
Channel Voltage/Current Analog Input
Module with HART; 1756-IF8H



(x2) Allen Bradley ControlLogix 8-
Channel Voltage/Current Analog Output
Module with HART; 1756-OF8H



(x2) Allen Bradley ControlLogix 8-
Channel Isolated RTD Input Module;
1756-IRT8I



(x1) Allen Bradley ControlLogix 16-Channel Isolated Contact Module; 1756-OW16I



(x1) Weidmuller PRO MAX 180W 24V 7.5A Power Supply; 1478120000



(x1) Allen Bradley ControlLogix 8-Channel Digital Input Module; 1756-OX8I



(x1) PRO MAX 480W 24V 20A Power Supply; 1478140000



(x4) Allen Bradley ControlLogix Slot Filler Module; 1756-N2



(x2) CONEC Series Cat6a RJ45 Inline Coupler; 17-150134



(x1) Allen Bradley 5-port Ethernet Unmanaged Switch; 1783-US5T



(x1) Stego Filter Fan Plus FPI enclosure fan assembly, 13 CFM; 018702-30



(x1) Hubbell-Wiegmann Ultimate series enclosure, N12 Double Door Wall-Mount 36X60X12 Carbon Steel - Gray



(x11) HARTING CBL CLAMP M20 6-12MM BRASS IP68; 19000005082



PLC Module Configuration & Interfacing

The following tables and associated figures describe the PLC module configuration for the HALEN System. The module slot order & module wiring details are described in this section.

The following table describes the PLC module configuration of the HALEN System:

Table 2. HALEN System - PLC Module Configuration Summary

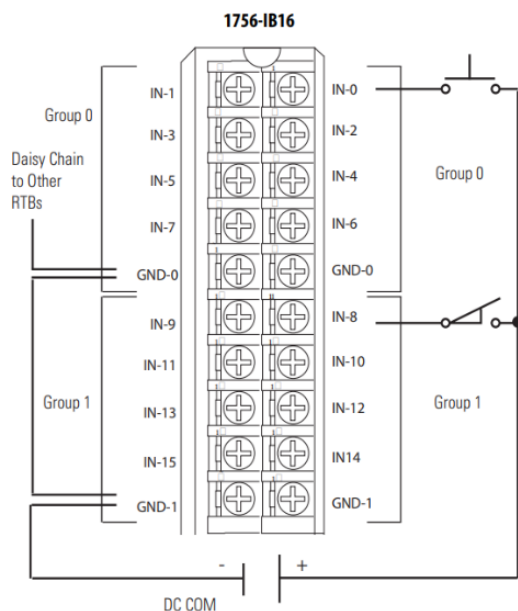
Chassis 1			
Chassis	# of Slots Used	Channel Count (Chassis I/O)	Associated Terminal Strip
1756-L83E	13	0	None
Chassis 1 Modules			
Module	Slot #	Channel Count	Associated Terminal Strip
1756-L83E	0	0	None
1756-IB16	1, 2	16	TB3A
1756-OB16D	3, 4	16	TB3B
1756-IF8H	5, 6	8	TB4A
1756-OF8H	7, 8	8	TB4B
1756-IRT8I	9, 10	8	TB5A
1756-OW16I	11	16	TB5B
1756-OX8I	12	8	TB5C
1756-N2	13, 14, 15, 16	0	None

1756-IB16 Module Specifications

16-Channel Digital Input Module:

The 1756-IB16 is a 16-ch sinking voltage (10-31.2 VDC) digital input module. The following figure shows the wiring pinout & specifications for the Allen Bradley 1756-IB16 module:

Figure 1. Wiring Diagram & Specifications for 1756-IB16 Module



1756-IB16 Specifications	
Inputs	16 (8 points/group)
Voltage Category	12/24V DC sink
Operating voltage range	10-31.2 VDC
Input voltage, nom	24 VDC
OFF to ON response	290 μ s nom/1 ms max + filter time
ON to OFF response	700 μ s nom/2 ms max + filter time
Current draw @ 5.1V	100 mA
Current draw @ 24V	2 mA
Total backplane power	0.56 W
Power dissipation, max	5.1 W @ 60°C (140°F)
Thermal dissipation	17.39 BTU/hr
Off-state voltage, max	5 V
Off-state current, max	1.5 mA
On-state current, min	2 mA @ 10 VDC
On-state current, max	10 mA @ 31.2 VDC
Inrush current, max	250 mA peak (decaying to < 37% in 22 ms, without activation)
Input impedance, max	3.12 k Ω @ 31.2 VDC
Cyclic update time	200 μ s-750 ms
Change of state	Software configurable

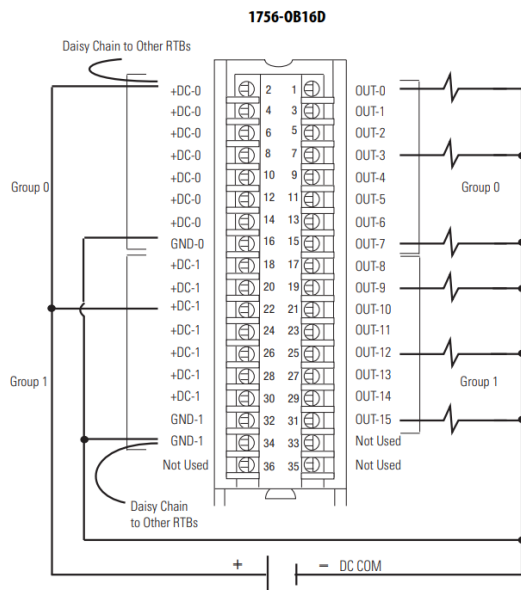
For additional information & specifications on the 1756-IB16 module see [1756 ControlLogix I/O Specifications.pdf](#)

1756-OB16D Module Specifications

16-Channel Digital Output Module:

The 1756-OB16D is a 16-ch sourcing voltage (19.2-30 VDC) digital output module. The following figure shows the wiring pinout & specifications for the Allen Bradley 1756-OB16D module:

Figure 2. Wiring Diagram & Specifications for 1756-OB16D Module



For additional information & specifications on the 1756-OB16D module see [1756 ControlLogix I/O Specifications.pdf](#)

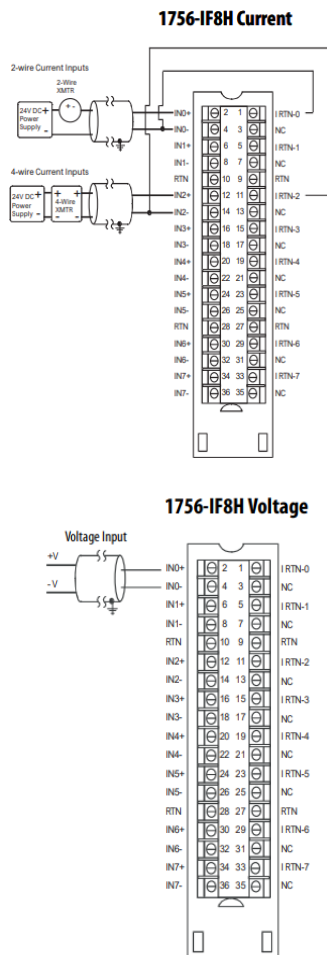
1756-OB16D Specifications	
Outputs	16 diagnostic (8 points/group)
Pilot duty	2 A (DC13-SQ)
Voltage category	24 VDC source
Operating voltage range	19.2-30 VDC
OFF to ON response	60 μ s nom/1 ms max
ON to OFF response	630 μ s nom/5 ms max
Current draw @ 5.1V	250 mA
Current draw @ 24V	140 mA
Total backplane power	4.64 W
Power dissipation, max	3.3 W @ 60°C (140°F)
Thermal dissipation	11.25 BTU/hr
Off-state leakage current per point, max	1 mA per point
On-state voltage drop, max	1.2 VDC @ 2 A
Current per point, max	2 A @ 30°C (86°F) linear derating 1 A @ 60°C (140°F) linear derating
Current per module, max	8 A @ 30°C (86°F) linear derating 4 A @ 60°C (140°F) linear derating
Surge current per point	4 A for 10 ms per point, repeatable every 1 s
Load current, min	3 mA per point
States in Fault mode per point	Hold last state, ON or OFF (OFF is default)
State in Program mode per point	Hold last state, ON or OFF (OFF is default)
Isolation voltage	250 V (continuous), basic insulation type, outputs-to-backplane, and output group-to-group No isolation between individual group outputs Routine tested @ 150 VAC for 2 s
Module keying	Electronic, software configurable
Fusing	Electronically fused per point

1756-IF8H Module Specifications

8-ch Voltage/Current Analog Input Module with HART:

The 1756-IF8H is a 8-ch Voltage/Current Analog Input Module with HART. The following figure shows the wiring pinout & specifications for the Allen Bradley 1756-IF8H module:

Figure 3. Wiring Diagram & Specifications for 1756-IF8H Module



For additional information & specifications on the 1756-IF8H module see [1756 ControlLogix I/O Specifications.pdf](#)

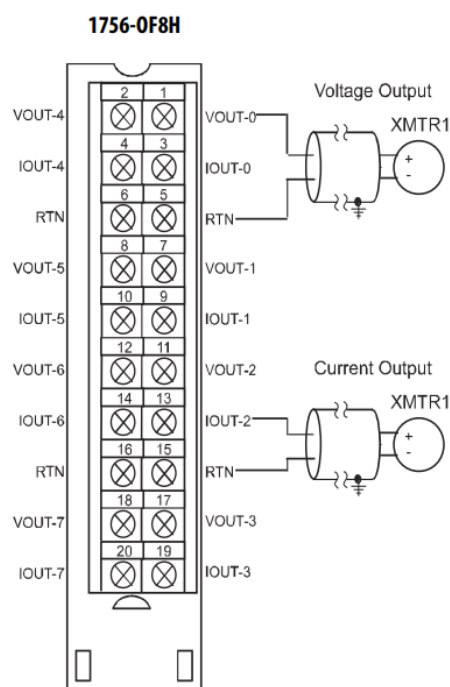
1756-IF8H Specifications	
Inputs	8 different voltage or current inputs, one HART modem per module
Input range	±10 V 0-5 V 1-5 V 0-10 V 0-20 mA 4-20 mA
Resolution	16-21 bits
Voltage and current ratings	Backplane: 5.1 VDC, 300 mA, 24 VDC, 135 mA Input voltage range: -10 – 10 V Input current range: 0-20 mA, 4-20 mA
Total backplane power	4.77 W
Power dissipation	Voltage: 3.21 W Current: 4.01 W
Thermal dissipation	Voltage: 11.0 BTU/hr Current: 13.7 BTU/hr
Open circuit detection time	Positive full scale reading within 5 s
Overvoltage protection, max	Voltage: 30 VDC Current: 8 VDC
Normal mode noise rejection	> 80 dB @ 50/60 Hz
Common mode noise rejection	> 100 dB @ 50/60 HZ
Calibrated accuracy	Voltage: Better than 0.05% of range Current: Better than 0.15% of range
Calibration interval	12 months
Offset drift	90 µV/°C
Gain drift with temperature	Voltage: 10 ppm/°C Current: 20 ppm/°C
Module error	Voltage: 0.1% of range Current: 0.3% of range
Module HART scan time	Analog: 18-488 ms (filter dependent). HART: typically 1 s per HART channel enabled.
Data format	Integer mode (left justified, 2 s complement) IEEE 32-bit floating point
Input conversion method	Successive approximation
Output conversion method	R-Ladder DAC, monotonicity with no missing codes
Isolation voltage	50 V (continuous), Basic insulation type, input channels to backplane No isolation between individual input channels Type tested at 1500 VAC for 60 s
Module keying	Electronic, software configurable

1756-OF8H Module Specifications

8-ch Voltage/Current Analog Output Module with HART:

The 1756-OF8H is a 8-ch Voltage/Current Analog Output Module with HART. The following figure shows the wiring pinout & specifications for the Allen Bradley 1756-OF8H module:

Figure 4. Wiring Diagram & Specifications for 1756-OF8H Module



For additional information & specifications on the 1756-OB16D module see [1756 ControlLogix I/O Specifications.pdf](#)

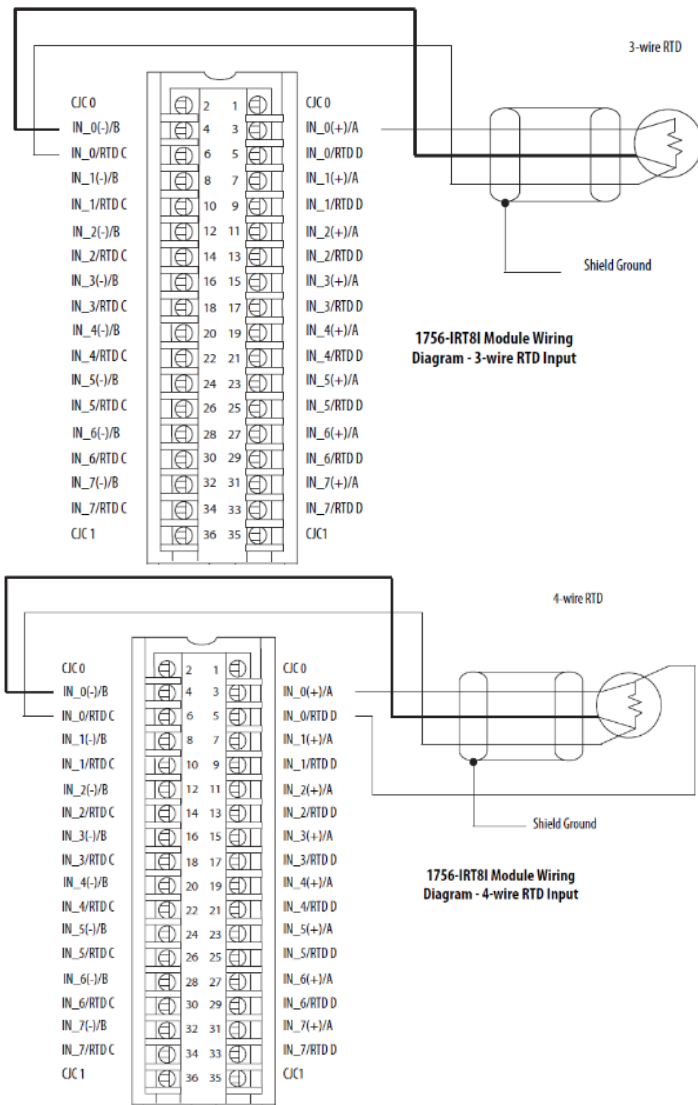
1756-OF8H Specifications	
Outputs	8 voltage or current, one HART modem per module
Output range	± 10 V 0-20 mA 4-20 mA
Resolution	15-16 bits for all ranges
Voltage and current ratings	Backplane: 5.1 VDC, 230 mA, 24 VDC, 230 mA Output voltage range: -10 – 10.4 V Output current range: 0-20 mA, 4-20 mA
Total backplane power	6.54 W
Power dissipation	4.92 W
Thermal dissipation	16.78 BTU/hr
Isolation voltage	50 V (continuous, basic insulation type, output channels to backplane No isolation between individual output channels Type tested at 1500 VAC for 60 s
Open circuit detection time	Current output only (output must be set to < 0.1 mA
Overvoltage protection, max	± 24 VDC
Load reactance, max	Voltage: 1 μ F Current: 10 μ F
Settling time	Current (no HART): < 23 ms to 95% with resistive loads Current (with HART): < 37 ms to 95% with resistive loads Voltage: < 8.5ms to 95% with resistive loads
Calibrated accuracy @ 25°C (77°F) with HART disabled	Voltage: Better than 0.1% of range Current: Better than 0.15% of range
Calibration interval	12 months typical
Offset drift	100 μ V/°C typical 200 nA/°C typical
Gain drift with temperature	Voltage: 20 ppm/°C Current: 35 ppm/°C
Module error	Voltage: 0.15% of range Current: 0.3% of range
Module HART scan time	Analog: 12 ms, min, floating point. HART: typically 1 s per HART channel enabled.
Data format	Integer mode (left justified, 2 s complement) IEEE 32-bit floating point
Input conversion method	Successive approximation
Output conversion method	R-Ladder DAC, monotonicity with no missing codes
Module keying	Electronic, software configurable

1756-IRT8I Module Specifications

8-Channel Isolated RTD Input Module:

The 1756-IRT8I is a 8-ch Isolated 3- and 4-wire RTD Input Module. The following figure shows the wiring pinout & specifications for the Allen Bradley 1756-IRT8I module:

Figure 5. Wiring Diagram & Specifications for 1756-IRT8I Module



For additional information & specifications on the 1756-IRT8I module see [1756 ControlLogix I/O Specifications.pdf](#)

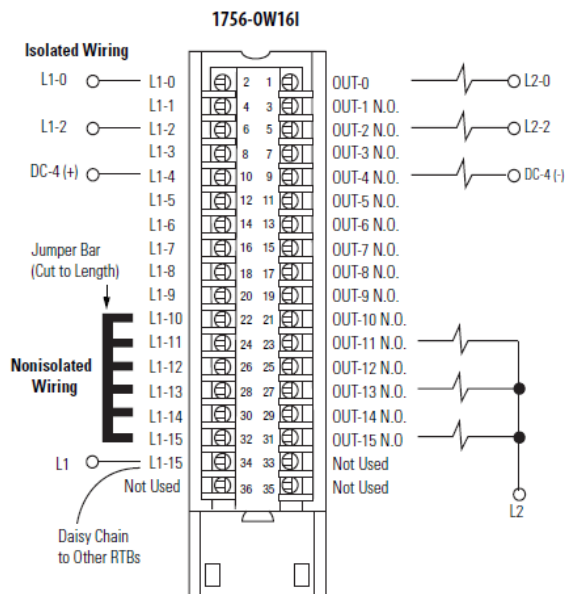
1756-IRT8I Specifications	
Inputs	8 isolated channels – Any combination of RTD or Thermocouple mode
Input range	1-500 Ω 2-1000 Ω 4-2000 Ω 8-4000 Ω -100 – 100 mV
Resolution	24 bits 0-510 Ω : 0.06 m Ω /count 0-1020 Ω : 0.12 m Ω /count 0-2040 Ω : 0.25 m Ω /count 0-4080 Ω : 0.50 m Ω /count -101 – 101 mV: 0.01 μ V/count
RTD sensors supported	100, 200, 500, 1000 Ω Platinum, alpha = 385 OR 3916 120 Ω Nickel, alpha = 672 100, 120, 200, 500 Nickel, alpha = 618 10 Ω Copper, alpha = 427
Thermocouple types	B, C, D, E, J, K, N, R, S, T, TXK/XK (L)
Thermocouple linearization	ITS-90
Current draw @ 5.1 V	200 mA
Current draw @ 24V	150 mA
Total backplane power	4.6 W
Power dissipation, max	4.6 W
Thermal dissipation	15.7 BTU/hr
RTD excitation current	600 μ A
Input impedance, approx.	1 G Ω
Open circuit detection time	Thermocouple input and 3 -wire RTD input = 2 s 4-wire RTD input = 5 s
Overvoltage protection, max	$\pm$ 30 VDC
Normal mode noise rejection	75 dB @ 60 Hz
Common mode noise rejection	125 dB @ 60 Hz 1000 Ω differential 120 dB @ 50 Hz 1000 Ω differential 160 dB @ 600 V 100 Ω differential
Calibrated accuracy @ 25°C	0.05%
Module error over full temperature range	0.1%
Local CJC sensor accuracy	$\pm$ 0.3°C
Remote CJC sensor, accuracy	$\pm$ 0.3°C
Module input scan time, min	1 ms
Data format	IEEE 32-bit floating point
Module conversion method	Sigma-Delta
Module keying	Electronic, software configurable

1756-OW16I Module Specifications

16-Channel Isolated Contact Module:

The 1756-OW16I is a 16-ch Isolated Contact Module that will be supplying (x16) of fused 24 VDC (1A) power. The following figure shows the wiring pinout & specifications for the Allen Bradley 1756-OW16I module:

Figure 6. Wiring Diagram & Specifications for 1756-OW16I Module



For additional information & specifications on the 1756-OW16I module see [1756 ControlLogix I/O Specifications.pdf](#)

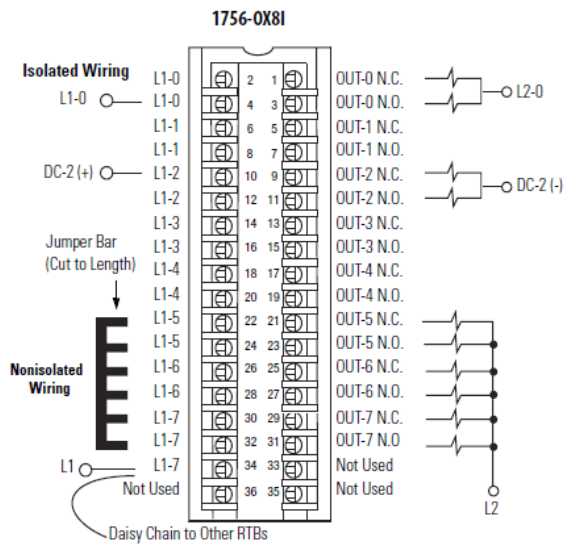
1756-OW16I Specifications	
Outputs	16 N.O. individually isolated
Pilot duty	C300/R150
Operating voltage range	5-125 VDC 10-240 VAC
Output voltage range (load dependent)	1 A @ 5-30 VDC 0.5 A @ 48 VDC 0.22 A @ 125 VDC 1.5 A @ 120 VAC 50/60 Hz 0.75 A @ 240 VAC 50/60 Hz
OFF to ON response	10 ms max
ON to OFF response	10 ms max
Current draw @ 5.1V	150 mA
Current draw @ 24V	150 mA
Total backplane power	4.4 W
Power dissipation, max	4.5 W @ 60°C (140°F)
Thermal dissipation	15.35 BTU/hr
Off-state leakage current per point, max	1.5 mA per point
Minimum load current	10 mA per point
Initial contact resistance, max	100 mΩ @ 6 V 1 A
Switching frequency, max	1 operation/3 s (0.3 Hz at rated load)
Bounce time, mean	1.2 ms
Expected contact life	300 kHz resistive 100 kHz inductive
Scheduled outputs	Synchronization within 16.7 s max, reference to the Coordinated System Time
States in Fault mode per point	Hold last state, ON or OFF (OFF is default)
States in Program mode per point	Hold last state, ON or OFF (OFF is default)
Isolation voltage	250 V (continuous), basic insulation type, output-to-backplane, and output-to-output Routine tested @ 1350 VAC
Module keying	Electronic, software configurable

1756-OX8I Module Specifications

8-Channel Digital Input Module:

The 1756-OX8I is a 8-ch 10-240 VAC/5-125 VDC Isolated Contact Module. The following figure shows the wiring pinout & specifications for the Allen Bradley 1756-OX8I module:

Figure 7. Wiring Diagram & Specifications for 1756-OX8I



For additional information & specifications on the 1756-OX8I module see [1756 ControlLogix I/O Specifications.pdf](#)

1756-OX8I Specifications	
Outputs	8 N.O. 8 N.C. individually isolated (two points per group)
Pilot duty	C300/R150
Operating voltage range	5-125 VDC 10-240 VAC
Output voltage range (load dependent)	1 A @ 5-30 VDC 0.5 A @ 48 VDC 0.22 A @ 125 VDC 1.5 A @ 120 VAC 50/60 Hz 0.75 A @ 240 VAC 50/60 Hz
OFF to ON response	13 ms max
ON to OFF response	13 ms max
Current draw @ 5.1V	100 mA
Current draw @ 24V	100 mA
Total backplane power	2.9 W
Power dissipation, max	3.1 W @ 60°C (140°F)
Thermal dissipation	10.57 BTU/hr
Off-state leakage current per point, max	0 mA per point
Minimum load current	10 mA per point
Initial contact resistance, max	100 mΩ @ 6 V 1 A
Switching frequency, max	1 operation/3 s (0.3 Hz at rated load)
Bounce time, mean	1.2 ms
Expected contact life	300 kHz resistive 100 kHz inductive
Scheduled outputs	Synchronization within 16.7 s max, reference to the Coordinated System Time
States in Fault mode per point	Hold last state, ON or OFF (OFF is default)
States in Program mode per point	Hold last state, ON or OFF (OFF is default)
Isolation voltage	250 V (continuous), basic insulation type, output-to-backplane, and output-to-output Routine tested @ 1350 VAC
Module keying	Electronic, software configurable

1756-L83E Processor Specifications

ControlLogix 5580 Processor 10MB PLC:

The following figure shows the wiring pinout & specifications for the Allen Bradley 1756-L83E PLC:

Figure 8. Wiring Diagram & Specifications for 1756-L83E PLC



1756-L83E Specifications	
Memory, Controller	10 MB memory
Memory Card Type	SD
Memory Card, Installed	2 GB
Memory Card Option	SD Card
Communication Ports (On Board)	USB (programming only) RJ-45
Communications Protocols	EtherNet/IP
Number of EtherNet/IP nodes, max	100 nodes
Maximum Digital I/O	128000
Maximum Analogue I/O	4000
Maximum Total I/O	128000
Safety Controller	No
Software, Configuration	RSLogix5000/Studio 5000 (Logix Designer)
Weight	0.394 kg
Power dissipation, max	6.2 W
Operating temperature, max	60°C
Operating temperature, min	0°C
Storage temperature, max	85°C
Storage temperature, min	-40°C
Relative humidity, max	95% RH
Humidity type	Non-condensing
Shock acceleration, max	30 g
Shock rating	IEC 60068-2-27
Vibration acceleration, max	2 g
Vibration frequency, operational, max	500 Hz
Vibration rating	IEC 60068-2-6

For additional information & specifications on the 1756-L83E PLC see [1756 ControlLogix and GuardLogix Controllers](#)

Terminal Block Wiring Diagram

The HALEN System's channel outputs are directly connected to labelled Weidmuller terminal blocks. To connect a field device to the HALEN system, follow the channel pinouts specified in the following table:

Table 3. HALEN System - Channel Pinout

HALEN System Channel Pinout			
Slot #	Channel #	Pinouts	Associated Terminal Blocks
Sinking Digital Inputs (Slots 1 & 2)			
1	0	24VDC IN-0	TB3A-3 TB3A-4
1	1	24VDC IN-1	TB3A-5 TB3A-6
1	2	24VDC IN-2	TB3A-7 TB3A-8
1	3	24VDC IN-3	TB3A-9 TB3A-10
1	4	24VDC IN-4	TB3A-11 TB3A-12
1	5	24VDC IN-5	TB3A-13 TB3A-14
1	6	24VDC IN-6	TB3A-15 TB3A-16
1	7	24VDC IN-7	TB3A-17 TB3A-18
1	8	24VDC IN-8	TB3A-20 TB3A-21
1	9	24VDC IN-9	TB3A-22 TB3A-23
1	10	24VDC IN-10	TB3A-24 TB3A-25
1	11	24VDC IN-11	TB3A-26 TB3A-27
1	12	24VDC IN-12	TB3A-28 TB3A-29

1	13	24VDC IN-13	TB3A-30 TB3A-31
1	14	24VDC IN-14	TB3A-32 TB3A-33
1	15	24VDC IN-15	TB3A-34 TB3A-35
2	0	24VDC IN-0	TB3A-38 TB3A-39
2	1	24VDC IN-1	TB3A-40 TB3A-41
2	2	24VDC IN-2	TB3A-42 TB3A-43
2	3	24VDC IN-3	TB3A-44 TB3A-45
2	4	24VDC IN-4	TB3A-46 TB3A-47
2	5	24VDC IN-5	TB3A-48 TB3A-49
2	6	24VDC IN-6	TB3A-50 TB3A-51
2	7	24VDC IN-7	TB3A-52 TB3A-53
2	8	24VDC IN-8	TB3A-55 TB3A-56
2	9	24VDC IN-9	TB3A-57 TB3A-58
2	10	24VDC IN-10	TB3A-59 TB3A-60
2	11	24VDC IN-11	TB3A-61 TB3A-62
2	12	24VDC IN-12	TB3A-63 TB3A-64
2	13	24VDC IN-13	TB3A-65 TB3A-66
2	14	24VDC IN-14	TB3A-67 TB3A-68
2	15	24VDC IN-15	TB3A-69 TB3A-70

Sourcing Digital Outputs (Slots 3 & 4)			
3	0	OUT-0 0VDC	TB3B-4 TB3B-5
3	1	OUT-1 0VDC	TB3B-6 TB3B-7
3	2	OUT-2 0VDC	TB3B-8 TB3B-9
3	3	OUT-3 0VDC	TB3B-10 TB3B-11
3	4	OUT-4 0VDC	TB3B-12 TB3B-13
3	5	OUT-5 0VDC	TB3B-14 TB3B-15
3	6	OUT-6 0VDC	TB3B-16 TB3B-17
3	7	OUT-7 0VDC	TB3B-21 TB3B-22
3	8	OUT-8 0VDC	TB3B-23 TB3B-24
3	9	OUT-9 0VDC	TB3B-25 TB3B-26
3	10	OUT-10 0VDC	TB3B-27 TB3B-28
3	11	OUT-11 0VDC	TB3B-29 TB3B-30
3	12	OUT-12 0VDC	TB3B-31 TB3B-32
3	13	OUT-13 0VDC	TB3B-33 TB3B-34
3	14	OUT-14 0VDC	TB3B-35 TB3B-36
3	15	OUT-15 0VDC	TB3B-37 TB3B-38
4	0	OUT-0 0VDC	TB3B-42 TB3B-43
4	1	OUT-1 0VDC	TB3B-44 TB3B-45
4	2	OUT-2 0VDC	TB3B-46 TB3B-47
4	3	OUT-3 0VDC	TB3B-48 TB3B-49

4	4	OUT-4 0VDC	TB3B-50 TB3B-51
4	5	OUT-5 0VDC	TB3B-52 TB3B-53
4	6	OUT-6 0VDC	TB3B-54 TB3B-55
4	7	OUT-7 0VDC	TB3B-59 TB3B-60
4	8	OUT-8 0VDC	TB3B-61 TB3B-62
4	9	OUT-9 0VDC	TB3B-63 TB3B-64
4	10	OUT-10 0VDC	TB3B-65 TB3B-66
4	11	OUT-11 0VDC	TB3B-67 TB3B-68
4	12	OUT-12 0VDC	TB3B-69 TB3B-70
4	13	OUT-13 0VDC	TB3B-71 TB3B-72
4	14	OUT-14 0VDC	TB3B-73 TB3B-74
4	15	OUT-15 0VDC	TB3B-75 TB3B-76
Voltage/Current Analog Inputs with HART (Slots 5 & 6)			
5	0	24VDC 0VDC IN0+ IN0- RTN-0 SHLD	TB4A-3 TB4A-4 TB4A-5 TB4A-6 TB4A-7 TB4A-8
5	1	24VDC 0VDC IN1+ IN1- RTN-1 SHLD	TB4A-9 TB4A-10 TB4A-11 TB4A-12 TB4A-13 TB4A-14

5	2	24VDC 0VDC IN2+ IN2- RTN-2 SHLD	TB4A-15 TB4A-16 TB4A-17 TB4A-18 TB4A-19 TB4A-20
5	3	24VDC 0VDC IN3+ IN3- RTN-3 SHLD	TB4A-21 TB4A-22 TB4A-23 TB4A-24 TB4A-25 TB4A-26
5	4	24VDC 0VDC IN4+ IN4- RTN-4 SHLD	TB4A-27 TB4A-28 TB4A-29 TB4A-30 TB4A-31 TB4A-32
5	5	24VDC 0VDC IN5+ IN5- RTN-5 SHLD	TB4A-33 TB4A-34 TB4A-35 TB4A-36 TB4A-37 TB4A-38
5	6	24VDC 0VDC IN6+ IN6- RTN-6 SHLD	TB4A-39 TB4A-40 TB4A-41 TB4A-42 TB4A-43 TB4A-44
5	7	24VDC 0VDC IN7+ IN7- RTN-7 SHLD	TB4A-45 TB4A-46 TB4A-47 TB4A-48 TB4A-49 TB4A-50
6	0	24VDC 0VDC IN0+ IN0- RTN-0 SHLD	TB4A-53 TB4A-54 TB4A-55 TB4A-56 TB4A-57 TB4A-58

6	1	24VDC 0VDC IN1+ IN1- RTN-1 SHLD	TB4A-59 TB4A-60 TB4A-61 TB4A-62 TB4A-63 TB4A-64
6	2	24VDC 0VDC IN2+ IN2- RTN-2 SHLD	TB4A-65 TB4A-66 TB4A-67 TB4A-68 TB4A-69 TB4A-70
6	3	24VDC 0VDC IN3+ IN3- RTN-3 SHLD	TB4A-71 TB4A-72 TB4A-73 TB4A-74 TB4A-75 TB4A-76
6	4	24VDC 0VDC IN4+ IN4- RTN-4 SHLD	TB4A-77 TB4A-78 TB4A-79 TB4A-80 TB4A-81 TB4A-82
6	5	24VDC 0VDC IN5+ IN5- RTN-5 SHLD	TB4A-83 TB4A-84 TB4A-85 TB4A-86 TB4A-87 TB4A-88
6	6	24VDC 0VDC IN6+ IN6- RTN-6 SHLD	TB4A-89 TB4A-90 TB4A-91 TB4A-92 TB4A-93 TB4A-94
6	7	24VDC 0VDC IN7+ IN7- RTN-7 SHLD	TB4A-95 TB4A-96 TB4A-97 TB4A-98 TB4A-99 TB4A-100

Voltage/Current Analog Outputs with HART (Slots 7 & 8)			
7	0	VOUT-0 OUT-0 RTN SHLD	TB4B-1 TB4B-2 TB4B-3 TB4B-4
7	1	VOUT-1 OUT-1 RTN SHLD	TB4B-5 TB4B-6 TB4B-7 TB4B-8
7	2	VOUT-2 OUT-2 RTN SHLD	TB4B-9 TB4B-10 TB4B-11 TB4B-12
7	3	VOUT-3 OUT-3 RTN SHLD	TB4B-13 TB4B-14 TB4B-15 TB4B-16
7	4	VOUT-4 OUT-4 RTN SHLD	TB4B-17 TB4B-18 TB4B-19 TB4B-20
7	5	VOUT-5 OUT-5 RTN SHLD	TB4B-21 TB4B-22 TB4B-23 TB4B-24
7	6	VOUT-6 OUT-6 RTN SHLD	TB4B-25 TB4B-26 TB4B-27 TB4B-28
7	7	VOUT-7 OUT-7 RTN SHLD	TB4B-29 TB4B-30 TB4B-31 TB4B-32
8	0	VOUT-0 OUT-0 RTN SHLD	TB4B-33 TB4B-34 TB4B-35 TB4B-36
8	1	VOUT-1 OUT-1 RTN SHLD	TB4B-37 TB4B-38 TB4B-39 TB4B-40

8	2	VOUT-2 OUT-2 RTN SHLD	TB4B-41 TB4B-42 TB4B-43 TB4B-44
8	3	VOUT-3 OUT-3 RTN SHLD	TB4B-45 TB4B-46 TB4B-47 TB4B-48
8	4	VOUT-4 OUT-4 RTN SHLD	TB4B-49 TB4B-50 TB4B-51 TB4B-52
8	5	VOUT-5 OUT-5 RTN SHLD	TB4B-53 TB4B-54 TB4B-55 TB4B-56
8	6	VOUT-6 OUT-6 RTN SHLD	TB4B-57 TB4B-58 TB4B-59 TB4B-60
8	7	VOUT-7 OUT-7 RTN SHLD	TB4B-61 TB4B-62 TB4B-63 TB4B-64
Isolated 3- and 4- Wire RTD Inputs (Slots 9 & 10)			
9	0	IN_0(+)/A IN_0(-)/B IN_0/RTD C IN_0/RTD D SHLD	TB5A-1 TB5A-2 TB5A-3 TB5A-4 TB5A-5
9	1	IN_1(+)/A IN_1(-)/B IN_1/RTD C IN_1/RTD D SHLD	TB5A-6 TB5A-7 TB5A-8 TB5A-9 TB5A-10
9	2	IN_2(+)/A IN_2(-)/B IN_2/RTD C IN_2/RTD D SHLD	TB5A-11 TB5A-12 TB5A-13 TB5A-14 TB5A-15

9	3	IN_3(+)/A IN_3(-)/B IN_3/RTD C IN_3/RTD D SHLD	TB5A-16 TB5A-17 TB5A-18 TB5A-19 TB5A-20
9	4	IN_4(+)/A IN_4(-)/B IN_4/RTD C IN_4/RTD D SHLD	TB5A-21 TB5A-22 TB5A-23 TB5A-24 TB5A-25
9	5	IN_5(+)/A IN_5(-)/B IN_5/RTD C IN_5/RTD D SHLD	TB5A-26 TB5A-27 TB5A-28 TB5A-29 TB5A-30
9	6	IN_6(+)/A IN_6(-)/B IN_6/RTD C IN_6/RTD D SHLD	TB5A-31 TB5A-32 TB5A-33 TB5A-34 TB5A-35
9	7	IN_7(+)/A IN_7(-)/B IN_7/RTD C IN_7/RTD D SHLD	TB5A-36 TB5A-37 TB5A-38 TB5A-39 TB5A-40
10	0	IN_0(+)/A IN_0(-)/B IN_0/RTD C IN_0/RTD D SHLD	TB5A-41 TB5A-42 TB5A-43 TB5A-44 TB5A-45
10	1	IN_1(+)/A IN_1(-)/B IN_1/RTD C IN_1/RTD D SHLD	TB5A-46 TB5A-47 TB5A-48 TB5A-49 TB5A-50
10	2	IN_2(+)/A IN_2(-)/B IN_2/RTD C IN_2/RTD D SHLD	TB5A-51 TB5A-52 TB5A-53 TB5A-54 TB5A-55

10	3	IN_3(+)/A IN_3(-)/B IN_3/RTD C IN_3/RTD D SHLD	TB5A-56 TB5A-57 TB5A-58 TB5A-59 TB5A-60
10	4	IN_4(+)/A IN_4(-)/B IN_4/RTD C IN_4/RTD D SHLD	TB5A-61 TB5A-62 TB5A-63 TB5A-64 TB5A-65
10	5	IN_5(+)/A IN_5(-)/B IN_5/RTD C IN_5/RTD D SHLD	TB5A-66 TB5A-67 TB5A-68 TB5A-69 TB5A-70
10	6	IN_6(+)/A IN_6(-)/B IN_6/RTD C IN_6/RTD D SHLD	TB5A-71 TB5A-72 TB5A-73 TB5A-74 TB5A-75
10	7	IN_7(+)/A IN_7(-)/B IN_7/RTD C IN_7/RTD D SHLD	TB5A-76 TB5A-77 TB5A-78 TB5A-79 TB5A-80
Fused 24VDC Powered Outputs (1A/point) (Slot 11)			
11	0	24VDC 0VDC	TB5B-1 TB5B-4
11	1	24VDC 0VDC	TB5B-5 TB5B-8
11	2	24VDC 0VDC	TB5B-9 TB5B-12
11	3	24VDC 0VDC	TB5B-13 TB5B-16
11	4	24VDC 0VDC	TB5B-17 TB5B-20
11	5	24VDC 0VDC	TB5B-21 TB5B-24
11	6	24VDC 0VDC	TB5B-25 TB5B-28
11	7	24VDC 0VDC	TB5B-29 TB5B-32

11	8	24VDC 0VDC	TB5B-33 TB5B-36
11	9	24VDC 0VDC	TB5B-37 TB5B-40
11	10	24VDC 0VDC	TB5B-41 TB5B-44
11	11	24VDC 0VDC	TB5B-45 TB5B-48
11	12	24VDC 0VDC	TB5B-49 TB5B-52
11	13	24VDC 0VDC	TB5B-53 TB5B-56
11	14	24VDC 0VDC	TB5B-57 TB5B-60
11	15	24VDC 0VDC	TB5B-61 TB5B-64
10-240 VAC/5-125 VDC Isolated Contacts (Slot 12)			
12	0	OUT-0 NC L1-0 OUT-0 NO	TB5C-1 TB5C-2 TB5C-3
12	1	OUT-1 NC L1-1 OUT-1 NO	TB5C-4 TB5C-5 TB5C-6
12	2	OUT-2 NC L1-2 OUT-2 NO	TB5C-7 TB5C-8 TB5C-9
12	3	OUT-3 NC L1-3 OUT-3 NO	TB5C-10 TB5C-11 TB5C-12
12	4	OUT-4 NC L1-4 OUT-4 NO	TB5C-13 TB5C-14 TB5C-15
12	5	OUT-5 NC L1-5 OUT-5 NO	TB5C-16 TB5C-17 TB5C-18
12	6	OUT-6 NC L1-6 OUT-6 NO	TB5C-19 TB5C-20 TB5C-21
12	7	OUT-7 NC L1-7 OUT-7 NO	TB5C-22 TB5C-23 TB5C-24

AC Power Input Termination

The HALEN System's AC Input should be directly connected to the following labelled Weidmuller terminal blocks. To terminate power to the HALEN system, follow the power pinouts specified in the following table:

Table 4. HALEN 115VAC/230VAC Power Termination Pinout

HALEN AC Termination Pinout	
AC Input Pinouts	Associated Terminal Blocks
100-240VAC 0VAC GROUND	TB1A-1 TB1A-2 TB1A-3

Additional Technical Documentation

Additional technical documentation for hardware components used in the HALEN System can be found and downloaded from the following table:

Table 5. HALEN System - Additional Technical Documentation

Hardware	OEM Part #	Technical Document
Allen Bradley PLC	1756-L83E	View Datasheet
16-ch Digital Input Module	1756-IB16	View Datasheet
16-ch Digital Output Module	1756-OB16D	View Datasheet
8-ch Voltage/Current Analog Input Module with HART	1756-IF8H	View Datasheet
8-ch Voltage/Current Analog Output Module with HART	1756-OF8H	View Datasheet
8-ch Isolated RTD/Thermocouple Analog Input Module	1756-IRT8I	View Datasheet
16-ch AC/DC Isolated Contact Module	1756-OW16I	View Datasheet
8-ch AC/DC Isolated Contact Module	1756-OX8I	View Datasheet
Allen Bradley 5-port Ethernet Unmanaged Switch	1783-US5T	View Datasheet
CONEC Series Cat6a RJ45 Inline Coupler	17-150134	View Datasheet
Weidmuller 180W, 24V, 7.5A AC/DC DIN Rail Power Supply	1478120000	View Datasheet

Weidmuller 480W, 24V, 20A AC/DC DIN Rail Power Supply	1478140000	View Datasheet
Stego Filter Fan Plus FPI enclosure fan assembly	018702-30	View Datasheet
HARTING CBL CLAMP M20 6-12MM BRASS IP68	19000005082	View Datasheet

Valkyrie Warranty & Support

The HALEN System comes with a 1-year replacement warranty that covers any defective hardware as specified by the original OEM. All control panels including the HALEN system undergo an extensive quality control & assurance process. All panels are UL508A certified (Standard). CSA General purpose certification is available upon request.

Our Engineers are available to answer any technical or troubleshooting questions regarding products, installation, and future design updates. Contact us directly at info@valkyriecontrols.com or through LinkedIn at www.linkedin.com/in/valkyrie-controls.

You can learn more about our other pre-engineered systems or request a free industrial panel design at www.valkyriecontrols.com

Valkyrie is committed to designing and manufacturing products in an environmentally responsible manner. Valkyrie recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to Valkyrie customers. Valkyrie Systems Inc. makes no express or implied warranties as to the accuracy of the OEM information contained herein and shall not be liable for any errors. U.S. Government Customers: The data contained in this manual was developed at private expense and is subject to the applicable limited rights and restricted data rights as set forth in FAR 52.227-14, DFAR 252.227-7014, and DFAR 252.227-7015.