

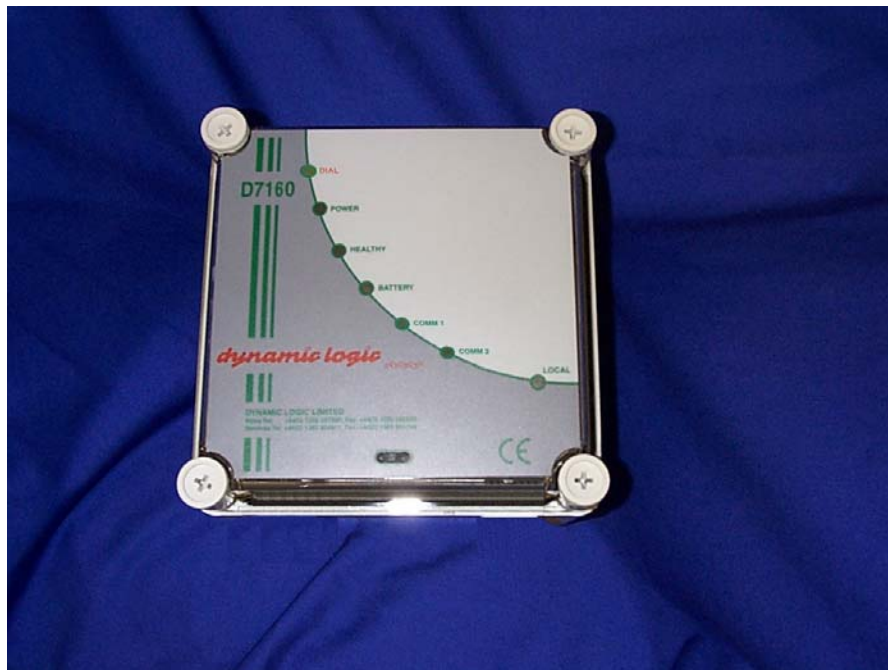


dynamic logic

D716x

Series Outstation Overview

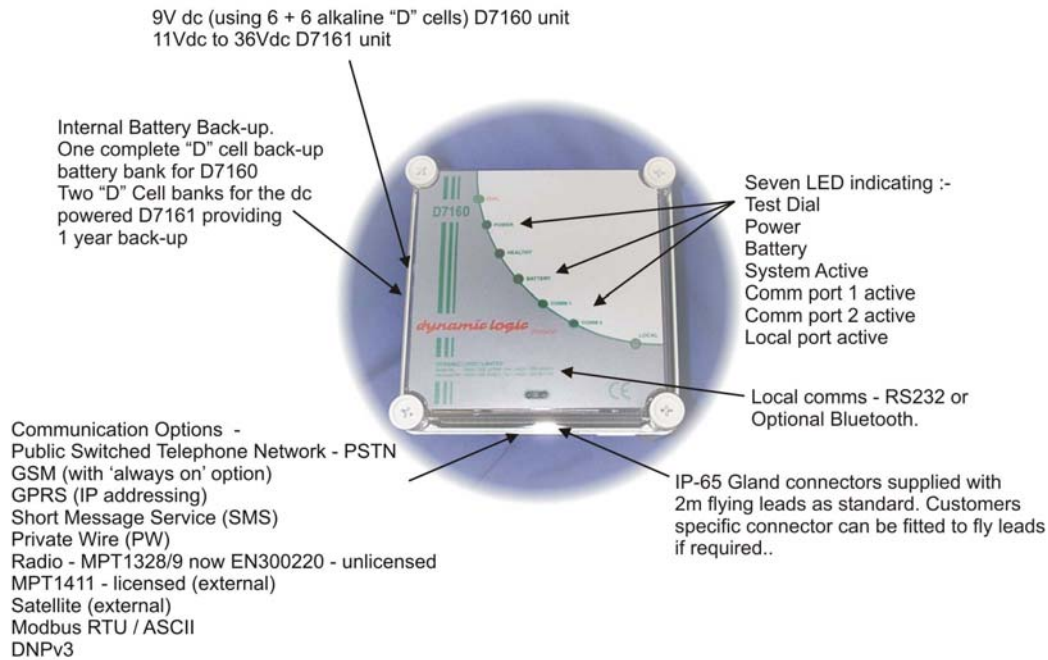
The D716x family is a range of IP65 Ultra low-power data logger/telemetry outstations. Two power options are available. The D7160 variant uses alkaline batteries that power the unit for up to 7 years, depending on usage and temperature conditions. The unit is available in a dc-powered (D7161) configuration with an internal battery back-up of up to 1 year. The D716x is designed for monitoring small I/O in harsh conditions when mains power is not readily available but the functionality and communication of an Outstation/RTU is still required. The D716x series fits Combined Sewer Overflow (CSO) monitoring perfectly and also leads itself to monitor and control a wide range of applications in the utilities and industrial markets.



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Data Logging Capacity available in extended blocks of memory:

Type	Standard	+ 1 Expansion	+ 2 Expansion
Digital Event	98,304 Logs	185,685 Logs	273,066 Logs
Analogue Event	73,728 Logs	139,264 Logs	204,800 Logs
Analogue Time	98,304 Logs	185,685 Logs	273,006 Logs

Actual quantity dependent on the mix.

A summary of features is given below:

Parameter	Specification
Power Supply Options	9Vdc (using 6 or 12 alkaline D cells) (D7160 unit) 11Vdc to 36Vdc (D7161 unit)
Internal Battery Back-up Options	One battery pack dc powered units (alkaline D cells)
Operating Temperature Range	-20°C to +70°C
Relative Humidity	0 to +95% @ +45°C (non-condensing)
Digital Inputs	0 - 6 Input: volt-free contacts: closed < 1kΩ, open > 100kΩ Input: open-collector (open-drain) transistor
Digital Outputs	2 volt-free photoMOS relay outputs rated 24V ac/dc @ 0.5A
Analogue Inputs	0 - 2 16-bit resolution max, 14-bit min. Accuracy ±0.05% Current, voltage, potentiometric 12Vdc and Vref pulsed sensor supplies with short-circuit protection
Counter Inputs	2 Inputs as per digital inputs 0 – 99999999 (eight decade)
Display	7 – Led status indicators on front panel dial, power, healthy, battery, comm.1, comm. 2 and local comms.
Serial Communication Ports	Two RS232 ports configured as one local (COM0), one internal for PSTN / CSDN modem (COM1), One optional port (COM2) configurable as RS232, RS485, RS422
Communication Medium	PSTN, GSM (Tri-band), Radio (external), Satellite (external), GPRS
Log size	>500KB
Sensor Connection	Glanded flying leads
Enclosure (W x H x D) IP ratings	188mm x 188mm x 128mm IP68 (enclosure), IP65 or optional IP67 (connectors)

Short-form Specifications

Common Specification across all Inputs

Alarm delay period	0 to 65535 seconds
Alarm Inhibit Period	0 to 65535 seconds
Special Phone Index	Promotes any back-up number in the telephone list to a Master number.

Digital Inputs

Number of real digital inputs. D7160: D7161:	Six maximum. Six maximum.
Number of pseudo digital inputs. D716x:	Two
Number of derived digital inputs.	Up to fifty.
Engineer-on-site timer.	0 to 65535 minutes (default = 60 minutes).
Scanning period.	One second for all digital inputs.
Signal detection.	Any duration down to one second.
Electrical characteristics:	Non-isolated. Internally pulled-up to +3Vdc.
Scan interval	15mSecs to 1 Sec
Holding current	3 μ A minimum.
Wetting current	32mA peak (4.7 μ s time constant).
Activation	Connect to 0V via external volt-free contacts, open-drain or open-collector inputs.

Analogue Inputs

Number of real analogue inputs. D7160: D7161:	Two maximum. Two maximum.
Number of derived analogue inputs.	Up to twenty-five.
Number of LADs per analogue	Up to four.
Scanning period.	1 to 65535 seconds (default = 900 seconds)
Time logging period.	0 (disabled) to 65535 minutes between readings
Input ranges and input impedance, Current:	0 – 1 mA, 1 k Ω minimum. 0 – 10 mA, 100 Ω minimum 1 – 10 mA, 100 Ω minimum 0 – 20 mA, 50 Ω minimum 4 – 20 mA, 50 Ω minimum
Input ranges and input impedance, Voltage:	0 – 1Vdc, 100 k Ω minimum 0 – 2Vdc, 100 k Ω minimum 0 – 5Vdc, 100 k Ω minimum 1 – 5Vdc, 100 k Ω minimum 0 – 10Vdc, 100 k Ω minimum

Input ranges, Potentiometric: The parallel resistance of potentiometric inputs on the unit must not fall below 2 kΩ. Potentiometric input, reference voltage.	2.048Vdc ± 5%
Isolation between input channels. Isolation between input channel and D716x. Measurement resolution. Accuracy over operating temperature range. Transducer power supply. Pre-scan power-up time.	30Vdc 500Vdc 16-bits / 15bit + sign (14-bits minimum) ±TBA% full scale 12Vdc ± TBA% (when measuring analogues) 0 to 4000ms, settable in 15ms increments

Count inputs

Count detection (contact only). Number of count inputs. D7160: 2 D7161: 2 Number of RADs per count. Scale factor (per pulse). Preset value. Roll-over value. Scanning period Time logging period Stored data format Signal detection Maximum frequency. Electrical characteristics (non-isolated) Holding current Wetting current Activation	Closing, opening or both. Two. 0.01 to 99.99 0 to 99999999 (8 decades maximum). 0 to 99999999 (8 decades maximum). 15ms to 1s 0 (disabled) to 65535 minutes between readings 5 or 8 decades (for all count inputs) Any duration down to 20ms. 25Hz Internally pulled-up to +3Vdc. 3µA 30mA surge or closing Connect to 0V via external volt-free contacts, open-drain or open-collector inputs
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Digital outputs

Output type: Number of digital outputs. D7160: Two maximum. D7161: Two maximum. Inch delay period. Isolation between digital outputs. Isolation between digital outputs and D716x. Rating (per output)	PhotoMOS relay 0 to 65535 seconds in 1ms increments. >5kVac. 5kVac. 24V ac or dc, 500mA maximum.
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Data Logging

The logging store on the D716x outstation is dependent on the memory purchased.

The eleven events that can be logged, along with their memory requirements, are given below: -

Type of event	Number of bytes
Digital Event	6
Digital Sequence	6
Analogue Event	8
Analogue Sequence	6
Analogue Time	6
Count Event	10
Count Sequence	8
Count Time	8
Global Event	12
Global Sequence	12
Global Time	36

The options available are a) no expansion RAM, b) 512kBytes or c) 1024kBytes. If the entire logging memory is used for one type of event then the typical number of logs is as follows: -

a) Standard D716x outstation with no expansion logging RAM

Type of event	Number of logs
Digital Event	32,768
Digital Sequence	32,768
Analogue Event	24,576
Analogue Sequence	32,768
Analogue Time	32,768
Count Event	19,660
Count Sequence	24,576
Count Time	24,576
Global Event	10,992
Global Sequence	10,992
Global Time	3,640

b) Standard D716x outstation with 512kByte expansion logging RAM

Type of event	Number of logs
Digital Event	120,149
Digital Sequence	120,149
Analogue Event	90,112
Analogue Sequence	120,149
Analogue Time	120,149
Count Event	72,089
Count Sequence	90,112
Count Time	90,112
Global Event	60,074
Global Sequence	60,074
Global Time	14,563

c) Standard D716x outstation with 1024Byte expansion logging RAM

Type of event	Number of logs
Digital Event	207,530
Digital Sequence	207,530
Analogue Event	155,648
Analogue Sequence	207,530
Analogue Time	207,530
Count Event	124,518
Count Sequence	155,648
Count Time	155,648
Global Event	43,690
Global Sequence	43,690
Global Time	14,563

There are certain limitations associated with logging that become important if large logs are intended to be used. I have listed them here – not in any order of importance.

- No single log can have more than 65,535 items in it.
- No log may occupy more than one block, i.e. the maximum individual log size is 512kB
- The log sizes given above are where the entire log is given over to one type of event. Where log events are mixed then the maximum number of logs will reduce according to how much memory is given over to the other type(s).
- Fragmentation may also occur when logs are deleted and new logs added. The effect of this is a reduced maximum number of logs capability. This fragmentation does not occur when a configuration is down-loaded. The command “CLEAR ALL LOG BUFFERS” issued from WinOPT will de-fragment the logging memory. Note however that this command will clear all the logged data.

Sequences

Sequences are user-written programs that provide flexible, local processing, calculation and control facilities within the D716x outstation, giving them a high level of local intelligence.

Up to sixteen individual sequences may be active within the D716x at any one time with varying degrees of interaction possible, together with automatic re-start on power-up (if required).

Each sequence program may accept up to ten parameters, which are then allocated to specific I/O or values at download time.

In addition to the full range of real I/O, the sequences may also write data to and read data from:-

- Up to twenty-five Derived Analogues.
- Up to fifty Derived Digitals.
- Up to fifty inter-sequence variables (use to pass information from one sequence to another).

The following table lists the reserved words, symbols and commands:

TRUE	-	<	(less than)	WHILE
FALSE	(subtract)	>	(greater than)	ENDWHILE
ON OFF	+ (add)	<=	(less than or equal)	EXIT
NORMAL	/ (divide)	to)		ON_ERROR
FAILED	*	>=	(greater than or	
NOT	(multiply)	equal to)		COMMS_FAIL
AND	MOD (modulo)	=	(equal to)	MAINS_FAIL
OR	POW (power)	AI	(Analogue Input)	BATTERY_LOW
XOR	ROOT	DI	(Digital Input)	GET_POINT(...)
@1	WAIT(...)	CI	(Count Input)	SET_POINT(...)
@2	WAIT_UNTIL	SE	(Shaft Encoder)	ALARM(...)
...		NYA		MONDAY
@10	HOUR	DO	(Digital Output)	TUESDAY
	DAY	AD	(Analogue Derived)	...
LOG	WEEK	DD	(Digital Derived)	SUNDAY
START(...)	NOW	PD	(Pseudo Digital)	
STOP(...)	DAY_OF_WEEK	IF		JANUARY
	DAY_OF_MONTH	ELSE		FEBRUARY
	RTC_MONTH	ENDIF		...
%1	RTC_YEAR	GOTO		DECEMBER
%2	RTC_HOUR	GOSUB		
...	RTC_MINUTE	RETURN		
%50	RTC_SECOND			

Site and Telephone Data

Site identity range.	0001 to 9999.
Security code range.	0001 to 9999.
The following applies to units with internal modems fitted:	
Telephone number list.	Up to five telephone numbers + one test dial number.
Digits per telephone number (including pauses)	Up to eighteen digits.
Communications type.	PSTN, GSM, SMS or CSDN

Communications (units with internal modems fitted)

Delay between dial-outs for successful call-out.	One minute. (between telephone numbers)
Delay between dial-outs (if number fails)	Three and a half minutes, but will try next number first after one minute;
(Once a number is successfully contacted, it is not tried again for the same alarm).	Retry three times (at least three and a half minutes apart, but may be longer if others are tried first);
	Try next number;
	Wait three minutes;
	Retry three times (three and a half minutes apart);
	Etc.
	Each unsuccessful number is backed-off for two hours; the cycle is then repeated.

Communications protocols.	D1236 FSK plus D4100 superset + D7xxx superset.
Modem transmission.	300 - 2400 baud. Port will support up to 115200 baud V22bis (2400 baud, 8 data bits, no parity, 1 stop bit) V22 (1200 baud, 8 data bits, no parity, 1 stop bit) V21 (300 baud, 8 data bits, no parity, 1 stop bit)

Communications (local)

WinOPT communication protocol.	D1236 FSK plus D4100 superset+ D7xxx superset.
Logging communication protocols.	D1236 FSK plus D4100 superset+ D7xxx superset.
Transmission (RS232).	300 baud to 115200 baud. 8 data bits, no parity, 1 stop bit.

Communications (auxiliary)

Communications Protocol.	Modbus (optional).
Transmission.	RS232/v24, RS485 or RS422 300 baud to 115200 baud 8 data bits, no parity, 1 stop bit.

Mechanical

Enclosure dimensions.	Height: 188 mm excluding connectors Width: 188mm Depth: 130mm
Average weight	TBA kg.
Maximum sensor wiring size.	1.5mm ² maximum.
Enclosure material.	Polycarbonate
Enclosure finish.	Base unit: Light-grey – RAL 7032 Lid: Clear polycarbonate with adhesive diagnostic label.

Electrical

Operating voltage.	D7160: 9Vdc (using six or twelve alkaline D cells) fused D7161: 11Vdc to 36Vdc (dc-powered option) fused
Sensor wiring.	Use screened twisted-pairs for all I/O. Connect screen to 0V.
Digital output loads.	Directly connected – do not exceed 24V ac or dc @ 500mA. Indirectly connected – larger loads may be switched if external interposing relays are used

Environmental

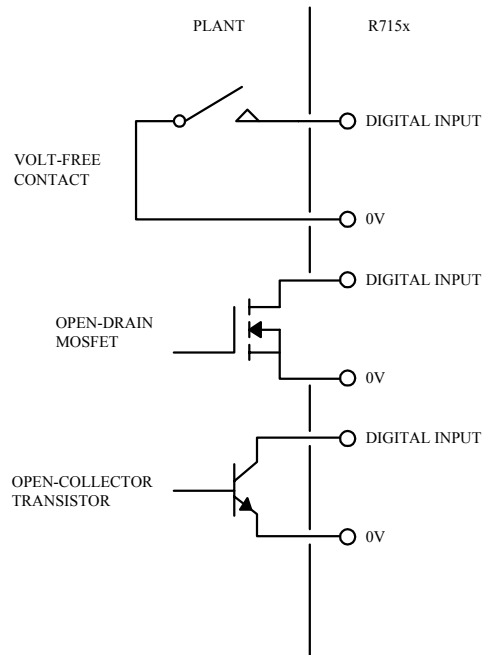
Operating temperature range.	-20°C to +70°C.
Storage temperature range.	-20°C to +70°C.
Temperature sensor accuracy	±1°C
Relative humidity at 45°C.	Up to 95% (non-condensing).
Enclosure ingress rating.	IP68.
Connector ingress rating.	IP65 (IP68 available as an option).

Real-time clock (RTC)

+10°C to +40°C.	better than 25 seconds per month – TBA
0°C to +50°C.	better than 50 seconds per month – TBA
-20°C to +70°C.	better than 90 seconds per month - TBA
Date.	Valid until year 2135.

Digital Inputs

Up to four digital inputs can be connected to a D716x unit. Volt-free contacts, open collector and open-drain inputs are supported as shown in the drawing below.



Digital Input Connections

The digital inputs are protected against reversal, transients, ac mains interference and contact bounce.

Count (Accumulator) Inputs

Count inputs provide a totalised count for digital inputs. Using WinOPT, any digital input can be configured as a count input. Volt-free contacts, open collector and open-drain inputs are supported. The following states can be counted:

- Opening contacts.
- Closing contacts.
- Opening and closing contacts.

Each count input can be configured with up to two independent trip points. These trip points (Rate Alarm detectors – RADs) may be used to trigger an alarm dial-out or an 'event' log on breaching a set value in any direction.

Digital Outputs

The two digital outputs utilise single pole normally open photoMOS relay contacts to provide switching functions. These outputs may be configured to close for any period up to 65535 seconds. As the D716 unit is intended primarily for low-power operation, it is recommended that these outputs be used to provide brief and infrequent signals e.g. process or initialisation.

In order to comply with the low-voltage directive, voltages to the digital output relay contacts must be limited to 24Vdc (0.5A maximum) or 24Vac (0.5A maximum), complying with safe extra low voltage (SELV).

All dangerous live voltages greater than SELV (50Vac or 75Vdc) must be terminated **externally** to the D716x enclosure, and be isolated from the D716x circuitry e.g. via interposing relays. When wiring to digital outputs to plant it is preferable to run a twisted-pair from the outstation to the power supply unit and relay, where possible. This reduces the risk of RFI pick-up.

Analogue Inputs

The D716x unit will support up to two analogue inputs. The inputs are galvanically isolated from the unit and are configured using a range of plug-in Signal Conditioning Modules (SCM). Each supported sensor input type, and corresponding SCM number is listed in the following table:

Sensor Type	SCM Number
0 – 1 mA	1
0 – 10 mA	2
1 – 10 mA	3
0 – 20 mA	4
4 – 20 mA	5
0 – 1Vdc	6
0 – 2Vdc	7
0 – 5Vdc	8
1 – 5Vdc	9
0 – 10Vdc	10
Potentiometric	11

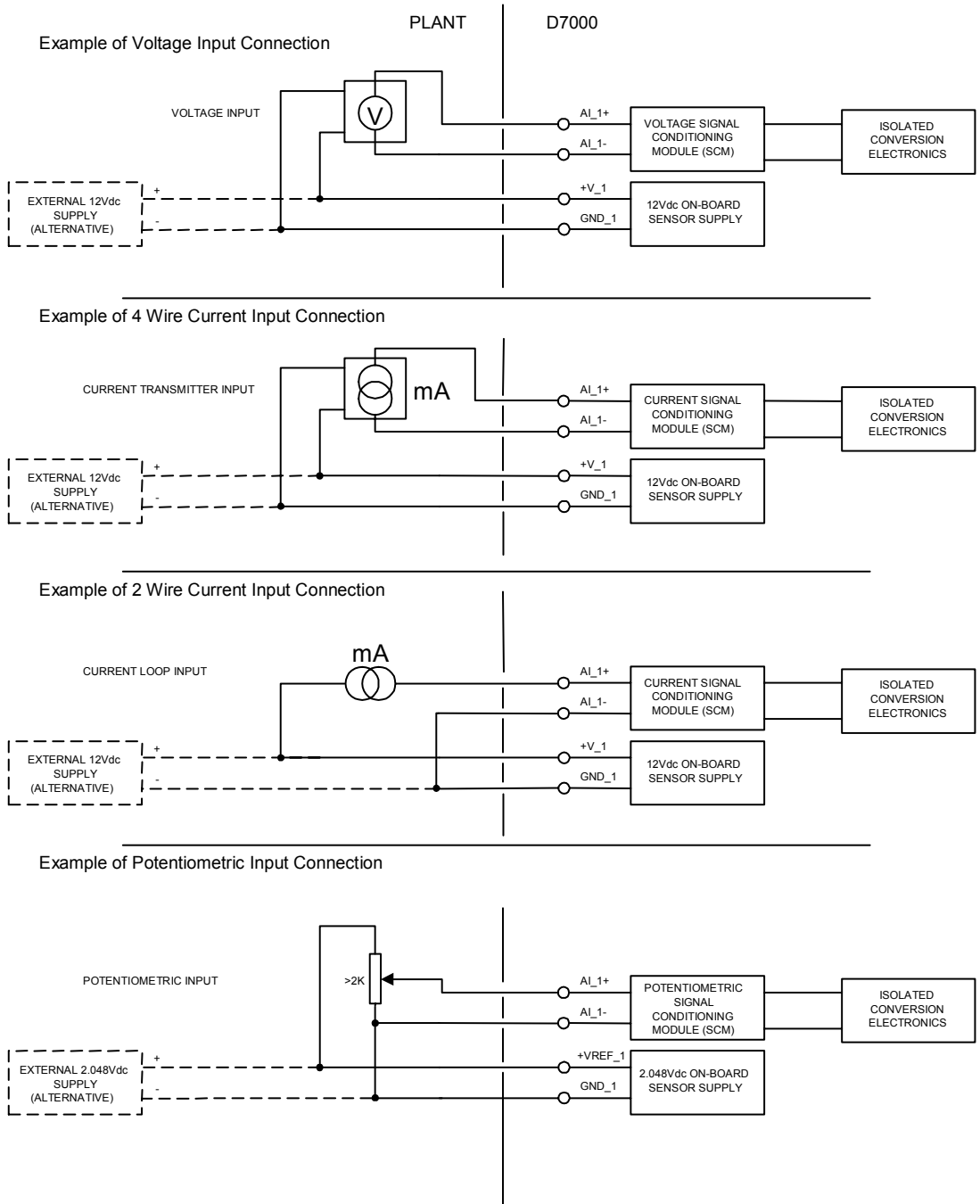
The required SCMs are specified at the customer order stage. The plug-in design allows field retrofits to be accomplished with relative ease.

The D716x unit is fitted with integral power supplies for sensor excitation. To save energy, the sensors are powered during the scan interval only. Two supply options are available:

- 12Vdc for current and voltage sensors
- 2.048Vdc for potentiometric sensors

Using WinOPT, the unit may be configured with a pre-scan power-up time in order to power the sensor between 1ms and 1999ms prior to measurement.

Either analogue input can be configured with up to four independent trip points. These trip points (Level Alarm Detectors - LADS) may be used to trigger an alarm dial-out or an 'event' logon breaching a set value in any direction.



Alternative Analogue Input Connections

MODBUS

The D716x unit will support MODBUS data both from the master station via a dial-up connection and to other outstations / PLCs connected to it on the secondary serial port. A maximum of 32 outstations / PLCs may be daisy chained on the RS458 data bus each individually addressed and scanned. (Note the maximum of 32 assumes that each PLC has the same single data-type e.g. digital inputs.) This maximum of 32 is reduced by each of the different types of inputs present e.g. if digital inputs and digital outputs are to be read in or out of each of the attached PLC's then the maximum number of PLC's that can be attached is reduced to 16. Similarly if digital inputs and outputs along with analogue inputs and outputs are to be read then the maximum number of PLCs that can be attached is reduced to 8.

The D716x unit can be configured to be master, where it will control the polling and data transfer to other MODBUS units / systems, or it can be set to be a slave where it will respond to other MODBUS masters.

The D716x MODBUS can be configured to communicate RTU or ASCII protocol. Note however that the serial port settings differ depending on the type of MODBUS selected. Both options are given below: -

- MODBUS RTU – 8 data bits, 1 stop bit, no parity
- MODBUS ASCII – 7 data bits, 1 stop bit, no parity

A fully integrated solution is available where MODBUS inputs and outputs are treated as native direct inputs and outputs. The D716x unit will time-stamp these inputs on receipt from the PLC. These may subsequently be used in sequences or other D716x control or monitoring strategies.

Note however that inputs from the MODBUS port will not be available at exactly the same time as native inputs therefore any strategy that combines local and MODBUS inputs to form alarm or control actions must take this delay into account.

The maximum I/O count of MODBUS data that can be treated as **native** inputs and outputs are as follows: -

Digital inputs	128
Analogue inputs	64
Digital outputs	32
Analogue outputs	32

An alternative method of interfacing to MODBUS data is PASSTHRU mode. This is in effect MODBUS in and MODBUS out. The D716x does not perform any processing on the data but becomes a telemetry MODBUS data gateway. In this mode there is no effective limit on the I/O other than what the PLC(s) already place. In this mode the limit on the number of external PLC's able to be connected to the RS485 data bus is 32.

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