Load Pro-B

Single Arm Load Controller

Dual Stage or DCV Flow Control

With option of Volume Correction

for Volumetric or Mass Frequency Flowmeters

Example of Ex D Enclosure

Features

- **Single Arm Load Controller with Dual Stage or Digital Valve Control**
- **Volume correction available to ASTM D1250-04**
- **Volume correction can be by combination of temperature, pressure and density inputs**
- **Applications tailored for Volumetric or Mass frequency flowmeters**
- **Multi compartment loading/unloading with operator prompts**
- **Stand-alone printer docket with compartment and summary details**
- **Allows quadrature flow input to ISO 6551 level B pulse security**
- **Allows for non-linear correction of flowmeters "K-Factor"**
- **Loads can be based on Gross Volume, Net Volume or Mass totals**
- **Can operate in Preset or On-Off batch mode (plus special mode for tuning)**
- **Provision for Deadman Timer with Alarm and Emergency Stop outputs**
- **Special start sequence provides Safety and Authorisation**
- **No-flow, leakage and overflow error detection**
- **External Emergency Stop logic input**
- **Allows for permissive for protective Earthing and Overfill with prompts**
- **Provision for gantry isolation or pump demand output**
- **ID Access validation available by ID-Pin number or ID-Tag (safe area only)**
- **Storage of 10000 logs records (500 latest transactions) with time and date stamp**
- **"User Tags" can be selected for custom text (or second language) on display**
- **Site and Delivery specific information can be entered during Start Sequence**
- **Custom codes (Product & Transport) can be setup via supporting 500-LP software**
- **Selectable protocols on serial ports including Modbus RTU and Printer output**
- **Backlit display & LCD backup on power fail to satisfy Custody Transfer requirements**
- **IECEx/ATEX and CSA approved Exd enclosure**
- **500-Series DataMod software available for collection and reporting of delivery data**

Overview

The Load Pro-B Load Controller has a range of application packs tailored to the various requirements found in single arm loading systems. It is a simple to use 5-key controller with the capabilities of Dual Stage or Digital Valve Control for the reliable and accurate delivery of preset quantities of liquid products. The frequency flow input, from volumetric or mass flowmeters, can accept a quadrature signal for ISO 6551 level B pulse security and temperature, pressure and/or density inputs can be used to provide volume correction. The controller can load on Volume(s) or Mass preset quantities.

The controller can be set to prompt for a valid Access ID (ID-Tag or Pin-Number), a range of job specific information and prompt for permissive inputs before a delivery can be commenced. The Access ID number and the job specific data is stored as a part of the logged transaction record and can be made available to external databases. A pump demand output and emergency stop inputs assist in catering for safe and controlled delivery of product in single arm loading applications.

A start sequence ensures a load or off-load will be carried out safely and recorded accurately, allowing for custom transaction information, compartment number, preset value and permissives to be manually entered or confirmed before the load or off-load commences.

Application Packs

Prior to shipping, the Load Pro-B load controller can be programmed with the application pack that best suits the loading system's needs. The table below is a selection guide for the Load Pro-B Application Pack. The basic selection is:

- Is Volume Correction required?
- Does the flow signal from the flowmeter represent Volumetric or Mass flow?

PETROLEUM VOLUME CORRECTION REQUIRED?	VOLUME or MASS FLOWMETER	LOAD-PRO APPLICATION CODE 515-LCxx or 515-LPxx
No **LC**xx	Volume Meter xxx**1**	LC01
	Mass Meter xxx**2**	LC02
Yes **LP**xx	Volume Meter xxx**1**	LP01
	Mass Meter xxx**2**	LP02

An example of a selected application:
515-LP01 - Volume Correction and a Volumetric flowmeter.
Other application features and system configuration, such as selection of Dual Stage or Digital Control Valve, can be programmed in field if required.

500 Load Program Manager

The 500-LP Load Program Manager is a Windows based computer configuration program that is supplied with a Load Pro unit and can be used to tailor a Load Pro-B controller for the specific requirements of a loading system. The 500-LP is also used to setup custom 2-digit code and 12 character text for easy operator selection/entry of load information Product or Source Field names and Transport Company names.

Calculations

The primary total and flowrate are derived from accurately measured frequency and the number of received pulses. The secondary total and flowrate are derived from the density value.

Application Pack (Flowmeter Type)	Primary Variable Calculation	Secondary Variable Calculation
LC01 & LP01 (Volumetric flowmeters)	*volume = pulses / k-factor* *volume flow = frequency / k-factor*	*mass = volume x density* *mass flow = volume flow x density*
LC02 & LP02 (Mass flowmeters)	*mass = pulses / k-factor* *volume flow = frequency / k-factor*	*volume = mass / density* *volume flow = mass flow x density*

In temperature compensated measurement applications, the corrected volume is derived from either a live temperature and/or density inputs or from fixed values in programming.

The volume correction calculations are based on the ASTM D1250-04 standard for the following products:

- Crude Oils
- Lube Oils
- Refined Products

Typical Configurations

A typical application with the valve type set for digital control valve (DCV) is shown below with Relay 3 providing the Open signal and Relay 4 providing the Hold signal. With the valve type set for Dual Stage, a two stage control valve can also be used with Relay 3 dedicated to slow flow and then combining with Relay 4 to achieve full flow.

The diagram shows how a Load Pro-B application LP01 can use temperature, pressure and/or density inputs for volume correction calculations and use DCV for flow control.

Displayed Information

The front panel display shows the current values of the input variables and the results of the calculations. A list of the variables for this application is shown below.

The instrument is supplied with a real-time clock for storage of up to 10000 time and date stamped records (500 latest load transactions with up to 18 compartments and a delivery summary for each).

Main Menu Variables

The following full list of main menu variables is reflective of the application packs **with** volume correction, which are **LP01 for Volumetric flowmeters** and **LP02 for Mass flowmeters**.

Main Menu Variables	Default Units	Variable Type	Logged/ Printed *	Comments
Net Volume	L	Total	Yes	Fluid volume corrected to reference conditions
Net Flowrate	L/min	Rate	No	Fluid volumetric flowrate corrected to reference conditions
Gross Volume	L	Total	Yes	LP01 - Fluid volume as measured by the flowmeter LP02 - Fluid volume as determined by density
Gross Flowrate	L/min	Rate	No	LP01 - Fluid volume flowrate as measured by the flowmeter LP02 - Fluid volume flowrate as determined by density
Mass	kg	Total	Yes	LP01 - Fluid mass as determined by density LP02 - Fluid mass as measured by the flowmeter
Mass Flowrate	kg/min	Rate	No	LP01 - Fluid mass flowrate as determined by density LP02 - Fluid mass flowrate as measured by the flowmeter
Temperature	Deg C	Rate	No	Fluid temperature (instantaneous)
Density	kg/m^3	Rate	No	Fluid Density (instantaneous)
Pressure	MPA	Rate	No	Fluid Pressure (instantaneous)
Average Temperature	Deg C	Rate	Yes	Fluid Temperature (averaged over the delivery)
Average Density	kg/m^3	Rate	Yes	Fluid Density (averaged over the delivery)
Average Pressure	MPA	Rate	Yes	Fluid Pressure (averaged over the delivery)

The following list of main menu variables is reflective of the application packs **without** volume correction, which are **LC01 for Volumetric flowmeters** and **LC02 for Mass flowmeters** that includes the simple conversion of Volume to Mass or Mass to Volume via a live or fixed density value.

Main Menu Variables	Default Units	Variable Type	Logged/ Printed *	Comments
Volume	L	Total	Yes	LC01 - Fluid volume as measured by the flowmeter LC02 - Fluid volume as determined by density
Volume Flowrate	L/min	Rate	No	LC01 - Fluid volume flowrate as measured by the flowmeter LC02 - Fluid volume flowrate as determined by density
Mass	kg	Total	Yes	LC01 - Fluid mass as determined by density LC02 - Fluid mass as measured by the flowmeter
Mass Flowrate	kg/min	Rate	No	LC01 - Fluid mass flowrate as determined by density LC02 - Fluid mass flowrate as measured by the flowmeter
Density	kg/m^3	Rate	No	Fluid Density (instantaneous)
Average Density	kg/m^3	Rate	Yes	Fluid Density (averaged over the delivery)

(* Logged/Printed variables can be included or excluded from the printed Delivery Dockets via the 500-LP Load Program Manager to tailor to the application needs.)

Note: In any application, the main menu total of primary interest can be set as the 'default' variable which the display will return to and any total can be used as the batch or preset variable.

Additional Variables

Although the following variables are not shown on the main menu, they are logged with the data for each compartment and/or delivery summary. The Start Sequence items can be individually disabled or enabled to appear as operator prompts depending on the customer and site requirements.
There is also the ability via the 500-LP Load Program Manager software to include or exclude an item from the printed Delivery Dockets.

Transaction Variables	Default Units	Variable Type	Logged/ Printed *	Comments
Batch Preset	QTY	Start Seq	Yes	Delivery Preset quantity, shown if PRESET mode.
Access ID Code	- - -	Start Seq	Yes	Access ID-Pin or ID-Tag code (if used) ID-Pin is 5 digit (2 digit Operator Identifier + 3 digit Access Pin). (ACCESS CODE)
Custom Job Number	- - -	Start Seq	Yes	6-digit Custom Number entered by operator during Start Seq. Can serve, for example, as a job number to be logged. (JOB NUM)
Custom Product Code	- - -	Start Seq	Yes	2-digit lookup code selected by operator during Start Seq. Associated text (max 12 chars) set via 500-PM. Can serve, for example, as a product/source code to be logged. (PROD CODE)
Custom Transport Code	- - -	Start Seq	Yes	2-digit lookup code selected by operator during Start Seq. Associated text (max 12 chars) set via 500-PM. Can serve, for example, as a transport/carrier company code to be logged. (TRANS CODE)
Custom Truck Registration Number	- - -	Start Seq	Yes	6-char (alpha/numeric) value entered by operator during Start Seq. Can serve, for example, as a truck registration number to be logged. (TRUCK REGO)
Custom Supplier Docket Number	- - -	Start Seq	Yes	6-digit Custom Number entered by operator during Start Seq. Can serve, for example, as a supplier docket number to be logged. (SUPPLY NUM)
Fluid Group**	- - -	Logged	Yes	Fluid Group indicates the type of fluid being measured and the calculations used for volume correction.
Base Temperature**	Deg C	Logged	Yes	Base temperature used for calculations during the delivery.
Base Density**	kg/m^3	Logged	Yes	Base density used for calculations during the delivery.

(* Logged/Printed variables can be included or excluded from the printed Delivery Dockets via the 500-LP Load Program Manager to tailor to the application needs.)

The displayed text for operator prompts for Custom items can be entered and tailored via the 500-LP.
(** these items are only relevant and shown for Volume Correction applications.)

Communications

There are two communication ports available: RS-232 port and RS-485 port. The ports are available for remote data reading, printouts and for initial application loading of the instrument.

Isolated Outputs

The output can function as either an output for retransmission of main menu variables, a flow error signal, a pump control output, an end of batch signal, emergency stop, or emergency pause signal. If retransmitting main menu variables, the type of output is determined by the nature of the assigned variable. Totals are output as pulses and rates are output as 4-20mA signals.

Relay Outputs

The relay outputs 3 and 4 are used to control the flow of product for each delivery. These contacts can operate as normally open and can be used to drive external relays, valves etc. Relay 2 is dedicated as line or gantry isolation, while Relay1 is an assignable relay and can be used as fully programmable alarm for any rate type variable.

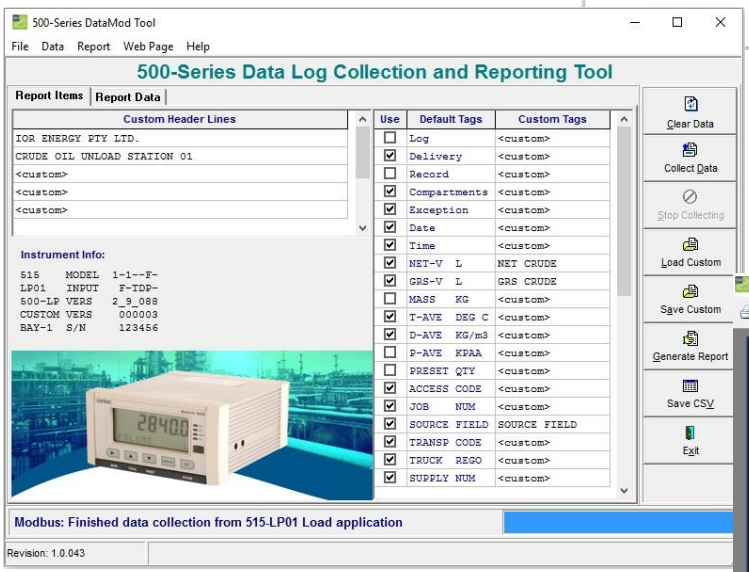
Software Configuration

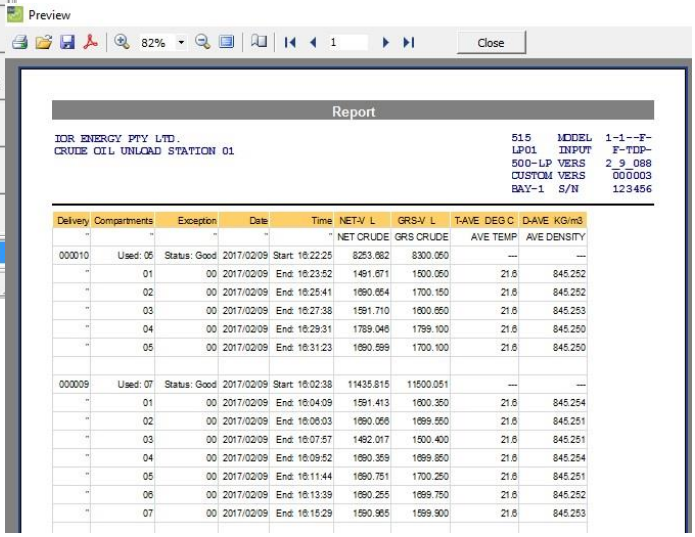
The instrument can be tailored to suit specific application needs including units of measurement, custom tags (alternate language), access levels and selection of items to be printed. The 500-LP Load Program Manager can be used to pre-program and configure these features. Instrument parameters (including units of measurement) can also be programmed in the field, depending on the user access levels assigned to parameters via the 500-LP.

All set-up parameters, totals and logged data are stored in non-volatile memory with at least 30 years retention.

Transaction Data and Printouts

The data from each transaction can be printed automatically at the end of a load or printed on command via the Print or Log menus. See page 10 for an example of a printed Delivery Docket. Transaction data can also be accessed via industry standard Modbus RTU. A Microsoft Windows based program "500 DataMod" is available from Contrec to provide easy extraction of logged data and generate reports that can be exported to PDF or CSV format.





Exceptions and Errors

The following is a basic list of the errors or exceptions that maybe raised to ensure safe and authorised operation continues at all times.

Load and Flow Errors	Description	Action and Acknowledgement
No Flow Detected	No Flow when valve is open.	Action: Load Paused, scroll error message, flash alarm LED and active OP-ERR output. Ack: Clear with press of STOP key. Options: Resume with RUN key. End compartment with hold of STOP key.
Overflow Detected	Overflow at End or when a load is Paused.	Action: Ensure valve closed. Scroll error message, flash alarm LED and active OP-ERR output. Wait for flow to stop. Ack: Clear with press of STOP key. Options: Resume paused load with RUN key. End compartment with hold of STOP key.
Leakage (or Theft) Detected	The 'leakage' condition is detected when an amount greater than the acceptable total is received without flow being initiated by the Load computer.	Action: Ensure valve closed. Scroll error message, flash alarm LED and active OP-ERR output. Wait for flow to stop. Ack: Clear with press of STOP key. Record flow and exception and end transaction.
Quad Input Error	The pulse security checking has detected a quadrature input error. A fault with wiring or flowmeter exists.	Action: Load Paused, scroll error message, flash alarm LED and active OP-ERR output. Ack: Clear with press of STOP or RESET key. Options: Resume with RUN key. End compartment with hold of STOP key.
Deadman Warning	The 'deadman warning' timer has expired while load is in Run or Paused status. Press a key to reset the timer. Programmable Timer (D-MAN timer).	Action: Scroll error message, flash alarm LED and active OP-ERR output. Ack: Clear warning with a press of any key OR unit will proceed to Deadman - Load Paused.
Deadman - Load Paused	The 'deadman emergency pause' timer has expired, the load is paused. Fixed Timer 30 secs	Action: Load Paused, scroll error message, flash alarm LED and active OP-ERR & E-PAUSE output. Ack: Clear warning with a press of any key OR unit will proceed to Deadman - Load Stopped Options: Resume load with RUN key. End compartment with hold of STOP key.
Deadman - Load Stopped	The 'deadman emergency stop' timer has expired, the current compartment is ended. Fixed Timer 120 secs	Action: Compartment ended, scroll error message, flash alarm LED and active OP-ERR & E-STOP output. Ack: Clear with press of STOP key. Options: Load More Compartments? YES/NO.
Earth Disconnected	Earth protection permissive was disconnected	Action: Load Paused, scroll error message, flash alarm LED and active OP-ERR output. Ack: Clear with press of STOP key. Options: Reconnect and resume with RUN key. End compartment with hold of STOP key.
Overfill Disconnected	Overfill permissive was disconnected	Action: Load Paused, scroll error message, flash alarm LED and active OP-ERR output. Ack: Clear with press of STOP key. Options: Reconnect and resume with RUN key. End compartment with hold of STOP key.

Modbus & DataMod Exceptions List

The following is list of the errors exceptions and status codes that can be read via Modbus and found in register **41 Exception/Status** or seen in the transaction data collected via the DataMod software.

General Exceptions
00 = no error
01 = analog input 1 failure
02 = analog input 2 failure
03 = analog input 3 failure
04 = analog input 4 failure
05 = invalid calibration parameter
06 = invalid reference parameter
07 = invalid property
08 = quadrature input error
09 = quadrature input frequency over limit
10 = process parameters out of range
11 = input is over limit

Flow/Control Exceptions
12 = no flow error detected
13 = overflow error detected
14 = leakage error detected

System Exceptions
20 = system failure
21 = power supply is low
22 = new or failed clock battery
23 = power cycled during load
24-29 = reserved

Specific Load Pro Exceptions
40 = General Load Exception
41 = Emergency Stop activated during load
42 = Permissive 1 (Earth) disconnection during load
43 = Permissive 2 (Overfill) disconnection during load
44 = Deadman Stop activated during load
45 = Deadman Pause activated during load
46 = Deadman Waring activated during load
47 = Load Ended

Terminal Designations

	Terminal Label		Designation	Comment
1	FINP	1+	Frequency Input 1+	Volume or Mass flow input 1
2	FINP	2+	Frequency Input 2+	Volume or Mass flow input 2 (Quadrature)
3	SG	-	Signal Ground	
4	EXC V	1+	Excitation Term 1+	Not Used
5	EXC V	2+	Excitation Term 2+	For AINP1 RTD input
6	EXC V	3+	Excitation Term 3+	Not Used
7	AINP1	+	Analog input ch 1 (+)	Temperature input (not used in LC applications)
8		-	Analog input ch 1 (-)	
9	AINP2	+	Analog input ch 2 (+)	Density input
10		-	Analog input ch 2 (-)	
11	AINP3	+	Analog input ch 3 (+)	Pressure input (not used in LC applications)
12		-	Analog input ch 3 (-)	
13	AINP4	+	Analog input ch 4 (+)	Not Used
14		-	Analog input ch 4 (-)	
15	Vo	+	8-24 volts DC output	Overload Protected
16	G	-	DC Ground	
17	Vi	+	DC power input	DC power in 12-28V
18	SH	E	Shield terminal	
19	RS485	+	RS485 (+)	Typically used for computer data collection via Modbus RTU
20		-	RS485 (-)	
21		G	RS485 ground	
22	LOGIC INPUTS	1+	Switch 1	Permissive 1 – Earth Protection
23		2+	Switch 2	Permissive 2 – Overfill Protection
24		3+	Switch 3	Emergency Stop
25		4+	Switch 4	CAL Switch – In field access protection
26		C-	Signal ground	
27	OUT1	+	Output ch 1 (+)	Assignable Output (Pump O/P Control)
28		-	Output ch 1 (-)	
29	OUT2	+	Output ch 2 (+)	Deadman / Emergency Stop (default)
30		-	Output ch 2 (-)	
31	RELAYS	RC	Relay common	
32		R1	Relay 1	Alarm (Deadman Warning)
33		R2	Relay 2	Line/Gantry Isolation
34		R3	Relay 3	DCV (Open) / Dual Stage (Slow)
35		R4	Relay 4	DCV (Hold) / Dual Stage (Full)
E	AC MAINS	E	Mains ground	AC power in 100 to 240VAC
N		N	Mains neutral	
A		A	Mains active	
RS232 port			9-pin serial port	Typically used for Delivery Docket Printer

Limitations of Use

Volume Correction

The volume correction calculations, if used, are based on the ASTM D1250-04 standard and are valid for the following ranges:

ASTM D1250-04

• Density: Crude:	611.2 ...1163.5 kg/m3 @ 15° C	0.6112 ...1.164 SG @ 60° F
• Density: Lube Oils:	801.3 ...1163.5 kg/m3 @ 15° C	0.8013 ...1.164 SG @ 60° F
• Density: Refined:	611.2 ...1163.5 kg/m3 @ 15° C	0.6112 ...1.164 SG @ 60° F
• Temperature (flow):	-50.0 ... 150° C	-58.0 ... 302° F

Operation outside these limits will raise an exception.

Quadrature Pulse Security

A quadrature pulse input is available on this instrument for Level B ISO 6551 pulse security and can be used for custody transfer applications.

When enabled, the two pulse trains from the quadrature flowmeter should be supplied to frequency inputs 1 and 2. The instrument will check for simultaneous pulses, missing pulses on channel 1 and missing pulses on channel 2. If more than two errors, of one of these fault types, occur within 4000 pulses the instrument will raise a quadrature input exception.

The time delay (phase shift) between the pulse trains should be at least 25usec.

Pulse security checking is performed from the pre-programmed cutoff frequency up to a maximum frequency of 3 kHz. An exception will be raised if the maximum frequency is exceeded. The flow calculations are always based on the pulses received on frequency input channel 1.

Approvals

This instrument conforms to the EMC-Directive of the Council of European Communities 2014/30/EU, the LVD safety directive 2014/35/EU and the following standards:

- EN61326:2013 Electrical equipment for measurement, control and laboratory use – EMC requirements: Industrial Environment.Generic.

- EN61010:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use.

In order to comply with these standards, the wiring instructions in the operation manual must be followed.

Calibration & Programming Setup Mode

In Calibration Set mode, you can change the settings of the “programmable” parameters. You must enter the system password to change the setting of the “password-protected” parameters.

Use the following procedure to enter Calibration Set mode:

1. Press to scroll to the **CAL MENU** prompt.

2. Hold the **SET** key.
The instrument beeps once, illuminates the **Cal** indicator and shows **CAL** on the display panel.

3. Press ▶ to select any flashing menu heading except **END**.

4. Hold **SET** for two seconds.
The instrument requests a password.

5. Press ▲ or ▼ to change the value of the current digit. To select the next digit, press ▶.

6. Press **SET** to accept the password.

- The instrument makes two beeps for a correct password entry and enables you to change the “programmable” and “password-protected” parameters.
- The instrument makes one beep for an incorrect password entry and enables you to change only the “programmable” parameters.

The instrument illuminates both the **Cal** and **Set** indicators.

7. Edit the instrument parameters as required. The programmable values are indicated by the flashing display.

- To change a numerical value, press ▲ to increase a value, or press ▼ to decrease a value. Press a key momentarily to change the value one number at a time. Hold a key to scroll through the numbers. To proceed to next digit, press ▶ .
- To change an option setting, press ▲ or ▼ to scroll through the options.

8. Press **SET** to accept the currently displayed value and proceed to the next parameter. You can press **DISPLAY** to return to the main calibration menu.

9. To exit from Calibrate Set mode, press ▶ to scroll through the main calibration menu to **END**, then press **SET** . Otherwise, from any menu, you can press and hold **SET** for two seconds.

The instrument makes two beeps and cancels the **Cal** and **Set** indicators.

Parameters Menu

The parameters menu consists of the following items (‘greyed’ items relate only to LP applications):

Parameter Menu Items	Description
ATM-PR units	Atmospheric absolute pressure value is added to the pressure sensor input if it is configured as a Gauge type sensor.
FLUID GROUP	Fluid group to ASTM D1250. In combination with the reference temperature and density it allows for the temperature/pressure correction of volume.
INPUT USAGE	This parameter allows to select which measured fluid property (temperature and/or density) is used for the volumetric correction. Select TEMP, DENS or BOTH.
T-REF units	Reference (base) temperature is required for the volumetric temperature correction (net calculations). Commonly used options: 15 deg C, 20 deg C or 60 deg F.
D-REF units	Reference (base) density is the density of fluid (petroleum) at the reference temperature. It is required for the volumetric temperature correction (net calculations) when only one input (temperature or density) is used.
BATCH ASSIGN	The batch can be assigned to any of the main menu variables that represent 'total'.
BATCH MODE	Select Batch mode as PRESET, ON-OFF and RELEASE. PRESET mode uses the slow start, prestop, overrun and preset quantity. ON/OFF mode uses slow start but relies on a manual stop to end the load. RELEASE mode is used to fully open the valve/s to verify full flow while in CAL MENU. Live flowrate & feedback is provided & Parameter items skipped.
D-MAN MODE	Enable or Disable the Deadman Timer function.
D-MAN SECS	Set the Deadman timer in the range 10-999. Default = 150 secs.
PUMP-T SECS	Pump off delay time 0-999. Default = 0 secs.
BATCH LIMIT	Maximum batch size allowed.
ACCEPT TOTAL	The batch acceptable total is the minimum total for the system leakage to be logged. A zero value disables logging of leakages.
T-OUT SECS	The flow timeout value is used to determine No Flow and Overflow errors. A zero value disables these error conditions.
S-STRT SECS	Slow Start time determines the minimum period of slow flow at the start or restart of a delivery.
S-STRT VALUE	Slow Start value determines the minimum amount of product to be transferred into the vessel before increasing to full flow.
P-STOP VALUE	Pre-Stop value determines the point at which the flow rate reduces from full flow to slow flow prior to the batch preset.
VALVE TYPE	Control Valve Type: The valve type can be chosen to suit the application. Available options are DUAL STAGE or DIGITAL CONTROL VALVE. If DUAL stage valve is selected the unrelated Control parameters are not shown or used.
D-BAND units	Control Dead Band: The control deadband can be programmed to prevent the output continuously changing and thereby reducing wear on valves.
CTRL FACT	Control Scaling Factor: Allows to fine tune the system response by scaling the control signal. Set the factor to lower values if it is desired to slow down the valve operation.
DIRECT ACCES	Enable or Disable Direct access of the following parameters from normal operation mode.
F-FLOW SP	Control Setpoint: Full Flow.
S-FLOW SP	Control Setpoint: Slow Flow.
O-RUN COMP	A fixed value that allows the system’s nominal overrun quantity to be offset or compensated for. (Not shown for ON/OFF batch mode).
PRESET BATCH	Load preset quantity to be delivered.

Inputs Menu

The input menu consists of the following items (‘greyed’ items relate only to LP applications):

Inputs Menu Items		Description
QUAD	INPUT	The quadrature input provides Level B pulse security to ISO 6551 standard and can be used in custody transfer applications. If the quadrature input is enabled, the additional flowmeter output should be connected to the frequency input 2.
FLOW	FINP1	Frequency input 1 is used for the flowrate input.
SIGNAL	FINP1	The frequency input accepts signals from many commonly used types of flowmeters including logic signals, turbine flowmeters, Namur proximity switches, etc.
DBNCE	FINP1	The frequency input debounce circuit can be useful in noisy environments. If debounce is enabled, the maximum input frequency for large amplitude signals is approximately 500 Hz and for low amplitude signals the maximum frequency is approximately 200 Hz.
CUTOFF	FINP1	Frequency cutoff value in Hertz is the value below which flowrate is not registered.
FILTER	FINP1	Input fluctuations, caused by pulsating flow through a flowmeter for instance, can be averaged out with an internal digital filter. The degree of filtering is determined by a programmed value where a higher value corresponds to heavier filtering.
CORR	FINP1	If the input sensor has non-linear characteristics, select NON-LINEAR to apply correction factors to the input signal.
NO-PTS	FINP1	The number of non-linearity correction points. This setting is applicable only for the non-linear correction type.
FREQxx	FINP1	Non-linearity correction factors. This setting is applicable only for the non-linear correction type. Enter the lowest correction factor frequency at factor 01 and proceed up to the higher frequencies.
KFACT1	FINP1	The K-factor of the connected flowmeter is the number of pulses that are output per unit of volume or mass.
T-FLOW	AINP1	Analog Input 1 is used for the fluid temperature input.
TYPE	AINP1	The analog input accepts signals from commonly used signal sources including 4-20 mA loop, 0-5V, etc. The default option enables the instrument to use a fixed value (set as the Default Point) for testing or other purposes.
PT-DEF	AINP1	The analog input default point can be used instead of the sensor signal when required. It is programmed in engineering units of the assigned process variable.
PT-MIN	AINP1	The analog input minimum point corresponds to the minimum input signal. It is programmed in engineering units of the assigned process variable.
PT-MAX	AINP1	The analog input maximum point corresponds to the maximum input signal. It is programmed in engineering units of the assigned process variable.
DENS	AINP2	Analog Input 2 is used for the fluid density input.
TYPE	AINP2	The analog input accepts signals from commonly used signal sources including 4-20 mA loop, 0-5V, etc. The default option enables the instrument to use a fixed value (set as the Default Point) for testing or other purposes.
PT-DEF	AINP2	The analog input default point can be used instead of the sensor signal when required. It is programmed in engineering units of the assigned process variable.
PT-MIN	AINP2	The analog input minimum point corresponds to the minimum input signal. It is programmed in engineering units of the assigned process variable.
PT-MAX	AINP2	The analog input maximum point corresponds to the maximum input signal. It is programmed in engineering units of the assigned process variable.

PRESS AINP3	Analog Input 3 is used for the pressure input.
PRESS AINP3	The pressure sensor type can be selected as Absolute or Gauge type ('A' or 'G' will be added to the displayed units of measure). If Gauge type is selected, the atmospheric pressure value is added to the pressure sensor input to derive absolute pressure.
TYPE AINP3	The analog input accepts signals from commonly used signal sources including 4-20 mA loop, 0-5V, etc. The default option enables the instrument to use a fixed value (set as the Default Point) for testing or other purposes.
PT-DEF AINP3	The analog input default point can be used instead of the sensor signal when required. It is programmed in engineering units of the assigned process variable.
PT-MIN AINP3	The analog input minimum point corresponds to the minimum input signal. It is programmed in engineering units of the assigned process variable.
PT-MAX AINP3	The analog input maximum point corresponds to the maximum input signal. It is programmed in engineering units of the assigned process variable.
EXCEPT DEFLT	When this option is enabled the instrument will use the default value instead of the live value for the analog input which raised the exception.

Outputs Menu

The outputs menu consists of the following items:

Outputs Menu Items	Description
FUNC OUT1/2	The output can function as either an output for retransmission of main menu variables, a flow error signal, a pump control output, an end of batch signal, an emergency stop or pause signal, or a 'run' (non-idle state) signal.
ASSIGN OUT1/2	You can assign any of the main menu variables to an output. The nature of the output depends on the assigned variable. Totals are output as pulses and rates are output as 4-20 mA passive signals.
WIDTH OUT1/2	Output pulse width in milliseconds (applicable only for a pulse output).
PULSE OUT1/2	Defines how many units of the assigned variable are accumulated to output a pulse (applicable only for a pulse output).
PT-MIN OUT1/2	The minimum point corresponds to the minimum output signal (applicable only for a 4-20mA output). It is programmed in engineering units of the assigned process variable.
PT-MAX OUT1/2	The maximum point corresponds to the maximum output signal (applicable only for a 4-20mA output). It is programmed in engineering units of the assigned process variable.

Alarms Menu

The alarms menu consists of the following items (‘greyed’ items relate only to LP applications):

Alarms Menu Items	Description
ASSIGN ALRM1	The relay alarm can be assigned to any of the main menu variables that represent 'rate'. If the Alarm Type is set to 'equipment failure', the assignment setting is ignored.
TYPE ALRM1	Select the type of relay alarm. If you select 'equipment failure' alarm, the Assignment, Setpoint and Hysteresis settings are ignored.
POINT ALRM1	The relay alarm setpoint is programmed in engineering units of the assigned process variable.
HYST ALRM1	The relay alarm hysteresis can be used to prevent an alarm toggling on and off when the assigned process variable is close to the setpoint. It is programmed in engineering units of the process variable.
DELAY ALRM1	The relay alarm delay is programmed in seconds and can be used to eliminate undesired alarm activation during startup or shutdown operation.

Comms Menu

The communications menu consists of the following items:

Comms Menu Items	Description
PROTOC RS232	Select the communication protocol for the RS232 port.
BAUD RS232	Select the baud rate for the RS232 port.
PARITY RS232	Select the parity for the RS232 port.
S-BITS RS232	Select the number of stop bits for the RS232 port.
PROTOC RS485	Select the communication protocol for the RS485 port.
BAUD RS485	Select the baud rate for the RS485 port.
PARITY RS485	Select the parity for the RS485 port.
S-BITS RS485	Select the number of stop bits for the R485 port.
RTU DATA	The data format for Modbus RTU protocol 2-register (4-byte) values.
RTU ADDR	The instrument address for Modbus RTU protocol. If there are multiple instruments connected to one master device, each instrument must have a unique address in the range of 1 to 247.
ASCII ADDR	The instrument address for Simple ASCII protocol. If there are multiple instruments connected to one master device, each instrument must have a unique address in the range of 1 to 255.
FLASH PORT	Select the communication port for receiving the instrument software downloaded from the Program Manager.

Time-Log Menu

The time-log menu consists of the following items:

Time-Log Menu Items	Description
DATE FORM	Date format of the real-time clock. DAY-M or M-DAY.
CLOCK YEAR	The Clock Year defines the current year for the real-time clock.
CLOCK M-DAY	The Clock Month-Day defines the current month and date for the real-time clock.
CLOCK H-MIN	The Clock H-MIN setting is the current time in hours and minutes for the real-time clock.
RESET LOGS	Reset the logged data. You may need to reset (clear) the logged data if you change the time/log settings. Press ▲ or ▼ to select YES, then press the **SET** key. The instrument makes three beeps to confirm the reset command.
REPORT TYPE	Select the logging report type for printer protocol.
PRN TYPE	Select the printer type for printer protocol.
AUTO PRINT	The automatic print feature allows to print delivery docket when current record is saved (batch finished). ENABLE or DISABLE

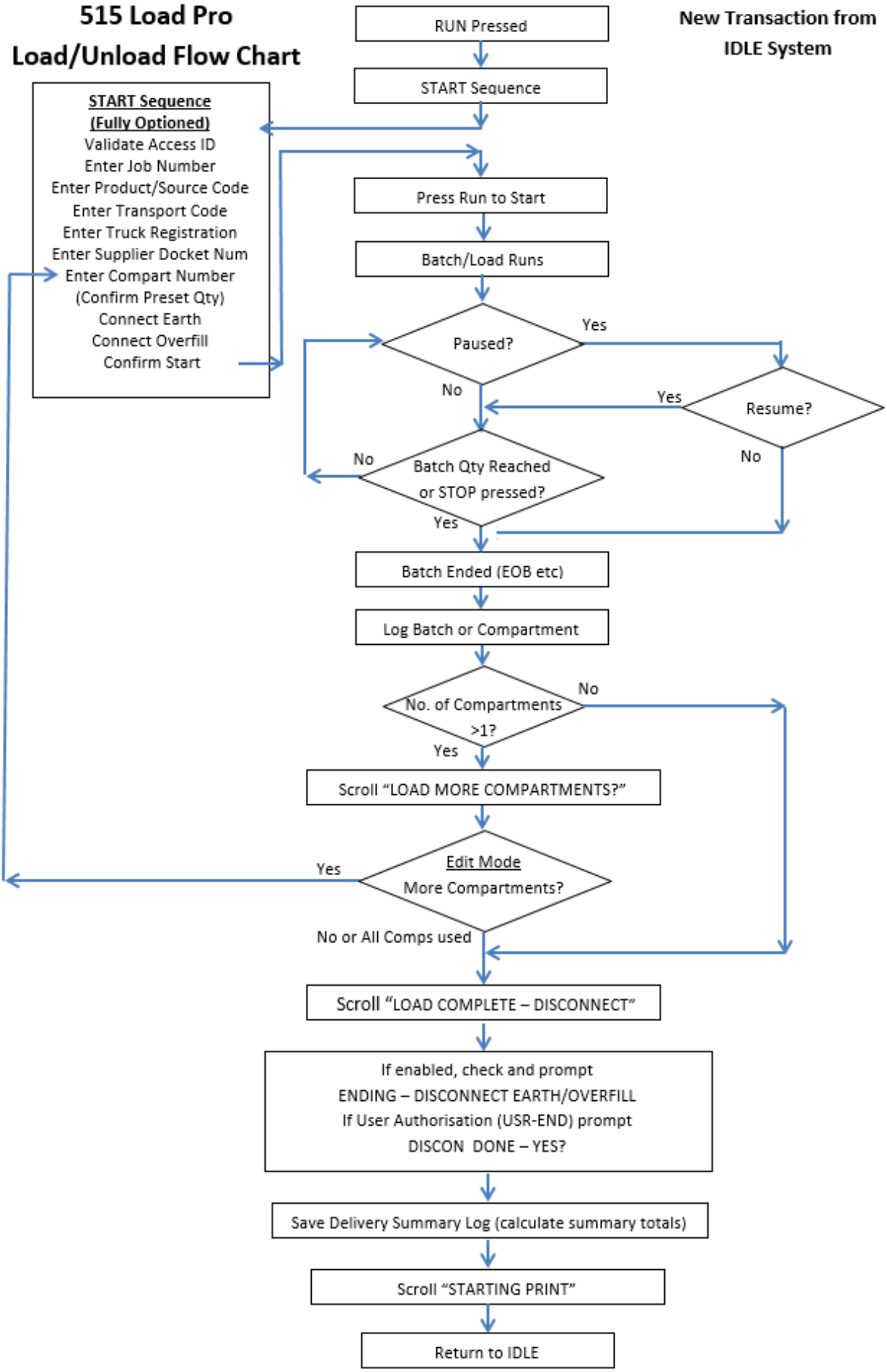
Setup Menu

The setup menu consists of the following items:

Setup Menu Items	Description
DEFAULT VAR	Select the main menu variable to display on power up or when the display timeout period has elapsed if it is enabled.
SUPPLY VOLT	Select the main menu variable to display on power up or when the display timeout period has elapsed if it is enabled.
T-OUT MODE	If the display timeout mode is enabled, and there is no user activity for the defined timeout period, the display panel returns to the default display. Select the display timeout mode as required.
T-OUT SEC	Define the delay period for the timeout in seconds.
RESET ACCUM	The user (according to the password protection) can reset the accumulated totals.
DISPL TAGS	The Display Tags option determines whether the instrument displays the default (English) tags or the user-defined tags.
BACK-L T-OUT	If the backlight timeout is enabled, and there is no user activity for the defined timeout period, the display backlight switches off allowing to save power, etc. Select the backlight timeout mode as required.
RATES DP	This parameter sets the maximum number of decimal places for displaying or printing main menu 'rates'.
TOTALS DP	This parameter sets the maximum number of decimal places for displaying or printing main menu 'totals'.
START SEQ	Start Option: Select batch starting sequence. OPT-1…OPT-x
JOB NUM	Start Option: Job Number. Allows to enable/disable the start sequence prompt for this item.
PROD CODE	Start Option: Product/Source Code. Allows to enable/disable the start sequence prompt for this item.
TRANSP CODE	Start Option: Transport/Carrier Code. Allows to enable/disable the start sequence prompt for this item.
TRUCK REGO	Start Option: Truck Registration Number. Allows to enable/disable the start sequence prompt for this item.
SUPPLY NUM	Start Option: Supplier Docket Number. Allows to enable/disable the start sequence prompt for this item.
NUMBER COMPS	Maximum number of compartments allowed in one transaction. (1-18)
PERMIS INP-3	Permissive Logic Input 3 (Earth). When permissive input is not disabled, batching will not be allowed until a permissive contact is closed and the delivery will be finalized (either automatically or by user confirmation) only when permissive is removed. (DISABLE, USR-END or AUT-END).
PERMIS INP-4	Permissive Logic Input 4 (Overfill). When permissive input is not disabled, batching will not be allowed until a permissive contact is closed and the delivery will be finalized (either automatically or by user confirmation) only when permissive is removed. (DISABLE, USR-END or AUT-END).
ACCESS TYPE	Allows to choose access ID type (authorisation). ID-NONE, ID-TAG, ID-PIN. ID-NONE disables the ID Access feature and there is no operator prompt. ID-TAG uses the iButton touch key with is printed on the delivery docket. ID-PIN uses a five-digit value. The first 2 digits are displayed in logging and printed on the delivery docket and can be used to identify the operator, while the remaining 3 digits are used as a hidden access pin code.
RESET CODES	The user (according to the password protection) can reset the access ID codes.
NO-PTS CODES	The number of access ID code points that can be programmed. 1 – 100.
ACCESS CODES	Access ID Code. ID-TAGS are entered and accepted by an authorised manager presenting the Touch Key to the reader. ID-PIN numbers are entered and accepted by an authorised manager using the front keys to enter a specific value for each operator to use to gain

	access to start a load.
PROD CODES (table)	Custom Table: Product/Source Codes. The custom table of codes (with associated text) can serve, for example, as product/source codes to be logged and printed. The content of the table is entered via 500-LP Program Manager and caters for up to 99 entries.
TRANS CODES (table)	Custom Table: Transport/Carrier Codes. The custom table of codes (with associated text) can serve, for example, as product/source codes to be logged and printed. The content of the table is entered via 500-LP Program Manager and caters for up to 99 entries.
PASSW VALUE	The password protects against unauthorized in-field changes. Configuration items marked as 'Password Protected' can be modified at the instrument front panel only after entering the correct password. The password is set via the 500 Load Program Manager software at the time of download and cannot be reset or altered via the instrument panel.

General Load Procedure



Delivery Dockets

Below is an example of the stand-alone delivery docket that is generated from the Load Pro-B 515-LP01. The example shows the format for single and multi-compartment transactions.

Single Compartment Transactions (when "No. of Compartments" = 1)

```
HALIFAX INDEPENDENT FUELS
SOWERBY BRIDGE DEPOT
LOAD BAY: 2A
PRODUCT:  HX1 UNLEADED PETROL

DELIVERY DOCKET (DUPLICATE)

PRINTED: 2016/05/21 16:29:20
SERIAL No: 123456   UNIT: BAY-13
--------------------------------
DELIVERY No: 000345 (SUMMARY)
COMPARTMENTS USED: 1
DELIVERY STATUS: GOOD
START TIME: 2016/05/21 16:18:46

ACCESS CODE:    14---
JOB    NUM:    016444
PROD   CODE:   (02) WARRIOR-9012
TRANSP CODE:   (14) QLD-TANKERS
TRUCK  REGO:   ABC123
SUPPLY NUM:    123456

NET-V  L         5111.8
GRS-V  L         5142.5
MASS   KG        4095.4
FLUID  GROUP        4
T-BASE DEG C       15.0
D-BASE KG/m3      850.0
--------------------------------
COMPARTMENT No:   1
DELIVERY STATUS: 00
END TIME:   2016/05/21 16:27:23
PRESET QTY       5000.0

NET-V  L         5111.8
GRS-V  L         5142.5
MASS   KG        4095.4
T-AVE  DEG C       21.5
D-AVE  KG/M3      796.579

--------------------------------


X_______________________________
Driver Signature
```

Multi-Compartment Transactions (when "No. of Compartments" > 1)

```
CUSTOM HEADER

DELIVERY DOCKET (DUPLICATE)

PRINTED: 2016/05/21 16:48:30
SERIAL No: 123456   UNIT: BAY-13
--------------------------------
DELIVERY No: 000345 (SUMMARY)
COMPARTMENTS USED: 2
DELIVERY STATUS: GOOD/EXCEPTIONS
START TIME: 2016/05/21 16:18:46

ACCESS CODE:    14---
JOB    NUM:    016444
PROD   CODE:   (02) WARRIOR-9012
TRANSP CODE:   (14) QLD-TANKERS
TRUCK  REGO:   ABC123
SUPPLY NUM:    123456

NET-V  L         10188.9
GRS-V  L         10245.0
MASS   kg         8160.9
FLUID  GROUP         4
T-BASE DEG C        15.0
D-BASE KG/m3       850.0

--------------------------------
COMPARTMENT No:   1
DELIVERY STATUS: 00
END TIME:   2016/05/21 16:27:23
PRESET QTY       5000.0

NET-V  L         5111.8
GRS-V  L         5142.5
MASS   KG        4095.4
T-AVE  DEG C       21.5
D-AVE  KG/M3      796.579
--------------------------------
COMPARTMENT No:   2
DELIVERY STATUS: 00
END TIME:   2016/05/21 16:36:15
PRESET QTY       5000.0

NET-V  L         5077.1
GRS-V  L         5102.5
MASS   KG        4065.5
T-AVE  DEG C       21.5
D-AVE  KG/M3      796.766
--------------------------------
CUSTOM FOOTER
```

The 500-LP Load Program Manager can be used to tailor to the application needs. Custom header and footer lines can be created and variables can be included or excluded on the printed Delivery Docket.

Specifications

Operating Environment

Temperature	-20°C to +60°C (conformal coating) +5°C to +40°C (no coating)
Humidity	0 to 95% non condensing (conformal coating) 5% to 85% non condensing (no coating)
Power Supply	100-240 V AC (+/-10%) 50-60 Hz (+/-10%) or 12-28 V DC
Consumption	6W (typical)
Protection	Sealed to IP65 (Nema 4X) when panel mounted
Dimensions	147mm (5.8") width 74mm (2.9") height 167mm (6.6") depth

Display

Type	Backlit LCD with 7-digit numeric display and 11-character alphanumeric display
Digits	15.5mm (0.6") high
Characters	6mm (0.24") high
LCD Backup	Last data visible for 15min after power down
Update Rate	0.3 second

Non-volatile Memory

Retention	> 30 years
Data Stored	Setup, Totals and Logs

Approvals

Interference	CE compliance
Enclosure	ATEX, FM, CSA and SAA approved enclosures available for hazardous areas

Real Time Clock (Optional)

Battery Type	3 volts Lithium button cell (CR2032)
Battery Life	5 years (typical)

Frequency Input (General)

Range	0 to 10kHz
Overvoltage	30V maximum
Update Time	0.3 sec
Cutoff frequency	Programmable
Configuration	Pulse, coil or NPS input
Non-linearity	Up to 10 correction points

Pulse

Signal Type	CMOS, TTL, open collector, reed switch
Threshold	1.3 volts

Coil

Signal Type	Turbine and sine wave
Sensitivity	15mV p-p minimum

NPS

Signal Type	NPS sensor to Namur standard

Analog Input (General)

Overcurrent	100mA absolute maximum rating
Update Time	< 1.0 sec
Configuration	RTD, 4-20mA, 0-5V and 1-5V input
Non-linearity	Up to 20 correction points (some inputs)

RTD Input

Sensor Type	PT100 & PT500 to IEC 751
Connection	Four Wire
Range	-200°C to 350°C
Accuracy	0.1°C typical (-100°C to 300°C)

4-20mA Input

Impedance	100 Ohms (to common signal ground)
Accuracy	0.05% full scale (20°C) 0.1% (full temperature range, typical)

0-5 or 1-5 Volts Input

Impedance	10MOhms (to common signal ground)
Accuracy	0.05% full scale (20°C) 0.1% (full temperature range, typical)

Logic Inputs

Signal Type	CMOS, TTL, open collector, reed switch
Overvoltage	30V maximum

Relay Output

No. of Outputs	2 relays plus 2 optional relays
Voltage	250 volts AC, 30 volts DC maximum (solid state relays use AC only)
Current	3A maximum

Communication Ports

Ports	RS-232 port RS-485 port (optional)
Baud Rate	2400 to 19200 baud
Parity	Odd, even or none
Stop Bits	1 or 2
Data Bits	8
Protocols	ASCII, Modbus RTU, Printer*

Transducer Supply

Voltage	8 to 24 volts DC, programmable
Current	70mA @ 24V, 120mA @ 12V maximum
Protection	Power limited output

Isolated Output

No. of Outputs	1 configurable output (plus 1 optional)
Configuration	Pulse/Digital or 4-20mA output

Pulse/Digital Output

Signal Type	Open collector
Switching	200mA, 30 volts DC maximum
Saturation	0.8 volts maximum
Pulse Width	Programmable: 10, 20, 50, 100, 200 or 500ms

4-20mA Output

Supply	9 to 30 volts DC external
Resolution	0.05% full scale
Accuracy	0.05% full scale (20°C) 0.1% (full temperature range, typical)

Important: Specifications are subject to change without notice.
Printer protocol is available only if RTC option is installed.

Ordering Information

Product Codes

Model	Supplementary Code							Description
515 .						-	LP01	
Enclosure	1							Panel mount enclosure
	2							Field mount enclosure (NEMA 4X / IP66)
	3/5							Explosion proof Ex d (IECEx/ATEX), metric glands (5 specifies heater)
	4/6							Explosion proof Ex d (CSA), NPT glands (6 specifies heater)
Output Options		0						4 logic inputs, 1 isolated output, 2 relays (only relay type 1 is available), RS232 (DB9) communication port
		1						4 logic inputs, 2 isolated outputs, 4 relays, real-time clock data logging, RS232 (DB9) and RS485 communication ports
		2/3						4 logic inputs, 2 isolated outputs, 4 relays, real-time clock data logging, RS232 (DB9) and Ethernet/RF communication ports (not yet available)
Relay Type			1					Electromechanical relays only
			2					2 electromechanical and 2 solid state relays
			3					Solid state relays only (not yet available)
Power Supply				U				Inputs for 12-28VDC and 100-240 VAC, 50-60Hz *(Previous Models: A = 110/120 VAC, E = 220/240 VAC)*
				D				Input for 12-28VDC power only
Display Panel Option					S			Standard option (now with backlight & LCD backup) *(original Full option: F, with Infra-Red comms, no longer available)*
PCB Protection						C		**Conformal coating** - required for maximum environmental operating range. Recommended to avoid damage from moisture and corrosion.
						N		**None** - suitable for IEC standard 654-1 Climatic Conditions up to Class B2 (Heated and/or cooled enclosed locations)
Application Pack Number							LP01	Defines the application software to be loaded into the instrument

Example full product part number is 515.311USC-LP01 (this is the number used for placing orders).

Distributed by:

Example of BZC-A5 IECEx/ATEX Enclosure

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