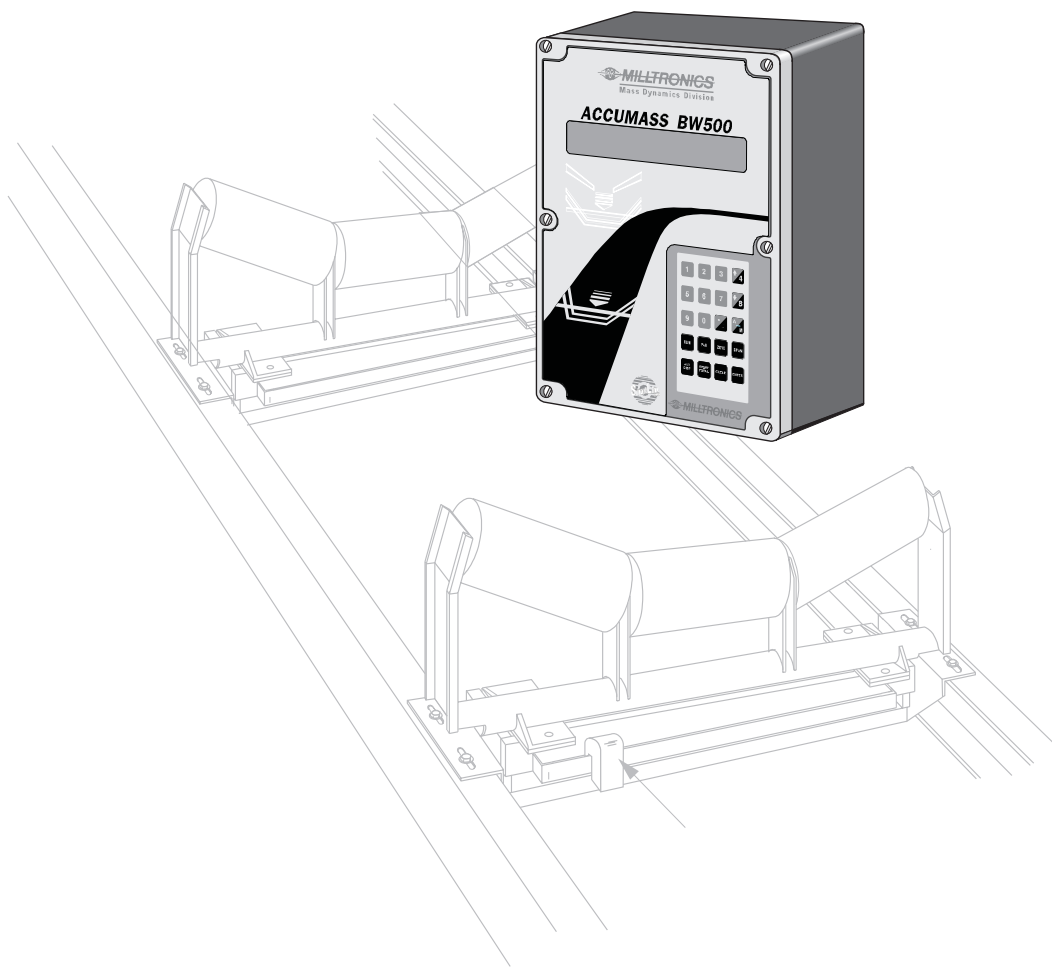


ACCUMASS BW500

Instruction Manual PL-565

January 2001



Safety Guidelines

Warning notices must be observed to ensure personal safety as well as that of others, and to protect the product and the connected equipment. These warning notices are accompanied by a clarification of the level of caution to be observed.

Qualified Personnel

This device/system may only be set up and operated in conjunction with this manual. Qualified personnel are only authorized to install and operate this equipment in accordance with established safety practices and standards.

Warning: This product can only function properly and safely if it is correctly transported, stored, installed, set up, operated, and maintained.

Note: Always use product in accordance with specifications.

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Table of Contents

About this.....	7
About This Manual	7
About the Accumass BW500	8
Accumass BW500 features:	8
Specifications.....	9
Installation	13
Dimensions	13
Optional Plug-ins.....	14
SmartLinx® Module	14
mA I/O board	15
Layout	16
Interconnection	17
System Diagram.....	17
Scale – One Load Cell	18
Scale – Two Load Cell	19
Scale – Four Load Cell.....	20
Scale – LVDT	21
Speed.....	22
Constant Speed (No Sensor)	22
Speed Sensor.....	22
Auxiliary Inputs.....	23
Auto Zero	23
RS-232 Port 1	23
Printers	23
Computers and Modems	24
Remote Totalizer.....	24
mA Output 1	24
Relay Output	25
RS-485 Port 2	25
Daisy Chain	25
Terminal Device	25
RS-232 Port 3	26
Power Connections.....	26
mA I/O Board	27
Installing/Replacing the Memory Back-up Battery	27
Start Up	29
Orientation	29
Display and Keypad	29
Program Mode	30
General.....	30
Run Mode	31
Initial Start Up	32
Power Up.....	32
Programming	32
Load Cell Balancing	35
Typical two load cell belt scale	35
Zero Calibration	38
Span Calibration	39
Run Mode	40

Recalibration	41
Belt Speed Compensation	41
Material Tests	42
% Change	42
Material Test	44
Design Changes	44
Recalibration	45
Routine Zero	45
Initial Zero	46
Direct Zero	46
Auto Zero	47
Routine Span	47
Initial Span	49
Direct Span	50
Multispan	50
Factoring	53
Linearization	54
Parameter Description	57
Start Up (P001 to P017)	58
Relay/Alarm Function (P100 - P117)	62
mA I/O Parameters (P200 - P220)	65
Calibration Parameters (P295 – 360)	69
Linearization Parameters (P390 - P392)	72
Proportional Integral Derivative (PID) Control Parameters, (P400 – P418)	73
Batch Control (P560 – P568)	76
Totalization (P619 - P648)	78
ECal Parameters (P693 – P698)	81
Communication (P750 - P792)	84
P750 – P769 SmartLinx [®] Module Specific Parameters	84
P770 – P789 Local Port Parameters	84
Test and Diagnostic (P900 - P951)	85
Operation	89
Load Sensing	89
Speed Sensing	89
Modes of Operation	89
Damping	90
mA I/O (0/4-20 mA)	91
Output	91
Input	91
Relay Output	91
Totalization	92
PID Control	95
Hardware	95
Connections	95
Setpoint Controller – Rate Control	96
Setpoint Controller – Load Control	96
Setpoint Controller – Master/Slave Control	97
Setpoint Controller – Rate and Load Control	98
Setup and Tuning	98
Proportional Control (Gain), <i>P</i>	98
Integral Control (Automatic Reset), <i>I</i>	99

Derivative Control (Pre-Act or Rate), <i>D</i>	99
Feed Forward Control, <i>F</i>	100
PID Setup and Tuning.....	100
Initial Start-Up.....	100
Programming	103
Batching.....	107
Connections	107
Typical Ladder Logic	107
Programming	108
Operation	109
Pre-act Function	109
Certification	111
Communications.....	113
BW500 and SmartLinx®	114
Connection.....	114
Wiring Guidelines	114
Configuring Communication Ports	115
P770 serial protocols.....	115
P771 protocol address	116
P772 Baud Rate	116
P773 Parity	116
P774 data bits	117
P775 stop bits.....	117
P778 modem attached	117
P779 modem idle time.....	117
P780 RS-232 transmission interval.....	118
P781 data message	118
Dolphin Protocol.....	120
Dolphin Plus Screen Shot	120
Modbus RTU/ASCII Protocol	121
How Modbus Works	121
Modbus RTU vs. ASCII	122
Modbus Format	122
Modbus Register Map	123
Modbus Register Map (cont'd)	125
Modems.....	133
Error Handling	135
Troubleshooting.....	137
Generally	137
Specifically.....	137
Error Codes.....	138
Appendices.....	139
Memory Backup	139
Software Updates	139
Calibration Criteria	139
Zero:	139
Span:	139
PID Systems:.....	139

About This Manual

It is essential that this manual be referred to for proper installation and operation of your BW500 belt scale integrator. As BW500 must be connected to a belt scale, and optionally a speed sensor, refer to their manuals as well.

<i>Installation</i>	gives you step by step instructions for the installation and interconnection of your BW500.
<i>Start Up</i>	instructs you on how to operate the keypad, read the display, do an initial Start Up for a successful entry into the run mode.
<i>Recalibration</i>	emphasizes how to optimize and maintain accurate operation of your weighing system through material tests and routine recalibrations.
<i>Operation</i>	offers an overview of the BW500 features and functions that allow you to take full advantage of your weighing system.
<i>Parameters</i>	lists the parameters available to you, with a description of their function and use. You are urged to read this section; to familiarize yourself with the parameters available to you and optimizes BW500 to maximum performance.
<i>Appendices</i>	this manual has an alphabetical cross reference of the parameters to their numbers, a diagnostic help with the list of error messages, a maintenance reminder, and a record sheet for jotting down parameter values.

About the Accumass BW500

Note:

The ACCUMASS BW500 is to be used only in the manner outlined in this instruction manual.

The ACCUMASS BW500 is a microprocessor based integrator designed for use with Milltronics, or equivalent belt scales and weigh feeders. The speed and load signals from the conveyor and scale, respectively, are processed to derive rate of material flow, and totalization. The primary values of speed and load, and the derived values of rate and total are available for display on the local LCD, or as output in the form of analog mA, alarm relay and remote totalization.

BW500 supports Milltronics Dolphin Plus software and Modbus protocol on the two RS-232 ports and the RS-485 port for communication to customer PLC or computer. BW500 also supports Milltronics SmartLinx[®] for communication with popular industrial communication systems.

Accumass BW500 features:

- Reliable and robust user interface
 - ✓ multi-field LCD display
 - ✓ local keypad
- Instrumentation I/O
 - ✓ two remote totalizer contacts
 - ✓ five programmable relays
 - ✓ five programmable discrete inputs
 - ✓ two programmable isolated mA input, for PID* control
 - ✓ three programmable isolated mA output for rate, load, speed or PID* control
- popular Windows[®] and Industrial communications
 - ✓ two RS-232 ports
 - ✓ one RS-485 port
- individual port configuration for:
 - ✓ Dolphin
 - ✓ Modbus ASCII
 - ✓ Modbus RTU
 - ✓ Printer
 - ✓ SmartLinx[®] compatible
- Controls and operation functions
 - ✓ load linearization
 - ✓ auto zero
 - ✓ PID* control
 - ✓ batch control
 - ✓ multispans operation

*PID control requires the optional mA I/O board.

Specifications

- Power:**
- o 100/115/200/230 V ac $\pm 15\%$, 50/60 Hz, 31 VA
 - o fuse, FU1: 2AG, Slo Blo, 2 A, 250 V or equivalent
- Application:**
- o compatible with Mass Dynamics belt scales or equivalent 1, 2 or 4 load cell scales.
 - o compatible with LVDT equipped scales, with use of optional interface board
- Accuracy:**
- o 0.1% of full scale
- Resolution:**
- o 0.02% of full scale
- Environmental:**
- o location: o indoor / outdoor
 - o altitude: o 2000 m max
 - o ambient temperature: o -20 to 50 °C (-5 to 122 °F)
 - o relative humidity: o suitable for outdoor (Type 4X / NEMA 4X /IP 65 enclosure)
 - o Installation category: o II
 - o pollution degree: o 4
- Enclosure:**
- o Type 4X / NEMA 4X / IP 65
 - o 285 mm W x 209 mm H x 92 mm D (11.2" W x 8.2" H x 3.6" D)
 - o polycarbonate
- Programming:**
- o via local keypad and/or Dolphin Plus interface
- Display:**
- o illuminated 5 x 7 dot matrix liquid crystal display with 2 lines of 40 characters each
- Memory:**
- o program stored in non-volatile FLASH ROM, upgradable via Dolphin Plus interface
 - o parameters stored in battery backed RAM, battery P/N 20200035 or use Rayovac #BR2335, 3V, Lithium or equivalent, 5 year life
- Inputs:**
- o load cell: o 0 - 45 mV dc per load cell
 - o speed sensor: o pulse train: 0 V low, 5-15 V high, 1 to 2000 Hz, or
 - o open collector switch, or
 - o relay dry contact
 - o auto zero: o dry contact from external device
 - o mA o see optional mA I/O board
 - o auxiliary o 5 discrete inputs for external contacts, each programmable for either: display scrolling, totalizer 1 reset, zero, span, multispans, print, batch reset, or PID function.

- Outputs:**
- mA:
 - 1 programmable 0/4 - 20 mA, for rate, load and speed output
 - optically isolated
 - 0.1% of 20 mA resolution
 - 750 Ω load max
 - see optional mA I/O board
 - load cell:
 - 10 V dc compensated excitation for strain gauge type, 4 cells max, 150 mA max
 - speed sensor:
 - 12 V dc, 150 mA max excitation
 - remote totalizer 1:
 - contact closure 10 - 300 ms duration
 - open collector switch rated 30 V dc, 100 mA max
 - remote totalizer 2:
 - contact closure 10 - 300 ms duration
 - open collector switch rated 240 V ac/dc, 100 mA max
 - relay output:
 - 5 alarm/control relays, 1 form 'A' SPST relay contact per relay, rated 5 A at 250 V ac, non-inductive
- Communications:**
- two RS-232 ports
 - one RS-485 port
 - SmartLinx[®] compatible (see options)
- Cable:**
- one load cell:
 - non-sensing:
 - Belden 8404, 4 wire shielded, 20 AWG or equivalent, 150 m (500 ft) max
 - sensing:
 - Belden 9260, 6 wire shielded, 20 AWG or equivalent, 300 m (1000 ft) max
 - two / four* load cells:
 - non-sensing:
 - Belden 9260, 6 wire shielded, 20 AWG or equivalent, 150 m (500 ft) max
 - sensing:
 - Belden 8418, 8 wire shielded, 20 AWG or equivalent, 300 m (1000 ft) max
- *for four load cell scale, run two separate cables of two load cell configuration
- speed sensor:
 - Belden 8770, 3 wire shielded, 18 AWG or equivalent, 300 m (1000 ft)
 - auto zero:
 - Belden 8760, 1 pair, twisted/shielded, 18 AWG, 300 m (1000 ft) max
 - remote total
 - Belden 8760, 1 pair, twisted/shielded, 18 AWG, 300 m (1000 ft) max
- Options:**
- Speed Sensor:
 - Mass Dynamics MD-36 / 36A / 256 or 2000A, or RBSS, or compatible
 - Dolphin Plus:
 - Milltronics Windows based software interface. Refer to associated product documentation
 - SmartLinx[®] Modules:
 - protocol specific modules for interface with popular industrial communications systems. Refer to associated product documentation.

- Mass Dynamics Incline Compensator:
 - for load cell excitation compensation on variable incline conveyors
- mA I/O board:
 - inputs:
 - 2 programmable 0/4 – 20 mA for PID, control
 - optically isolated
 - 0.1% of 20 mA resolution
 - 200 Ω input impedance
 - outputs:
 - 2 programmable 0/4 – 20 mA for PID control, rate, load and speed output
 - optically isolated
 - 0.1% of 20 mA resolution
 - 750 Ω load max
- output supply
 - isolated 24 V dc at 50 mA, short circuit protected
- LVDT interface card:
 - for interface with LVDT based scales
- 2.6 kg (5.7 lb.)
- CE*, CSA_{NRTL/C}
 - *EMC performance available upon request

Weight

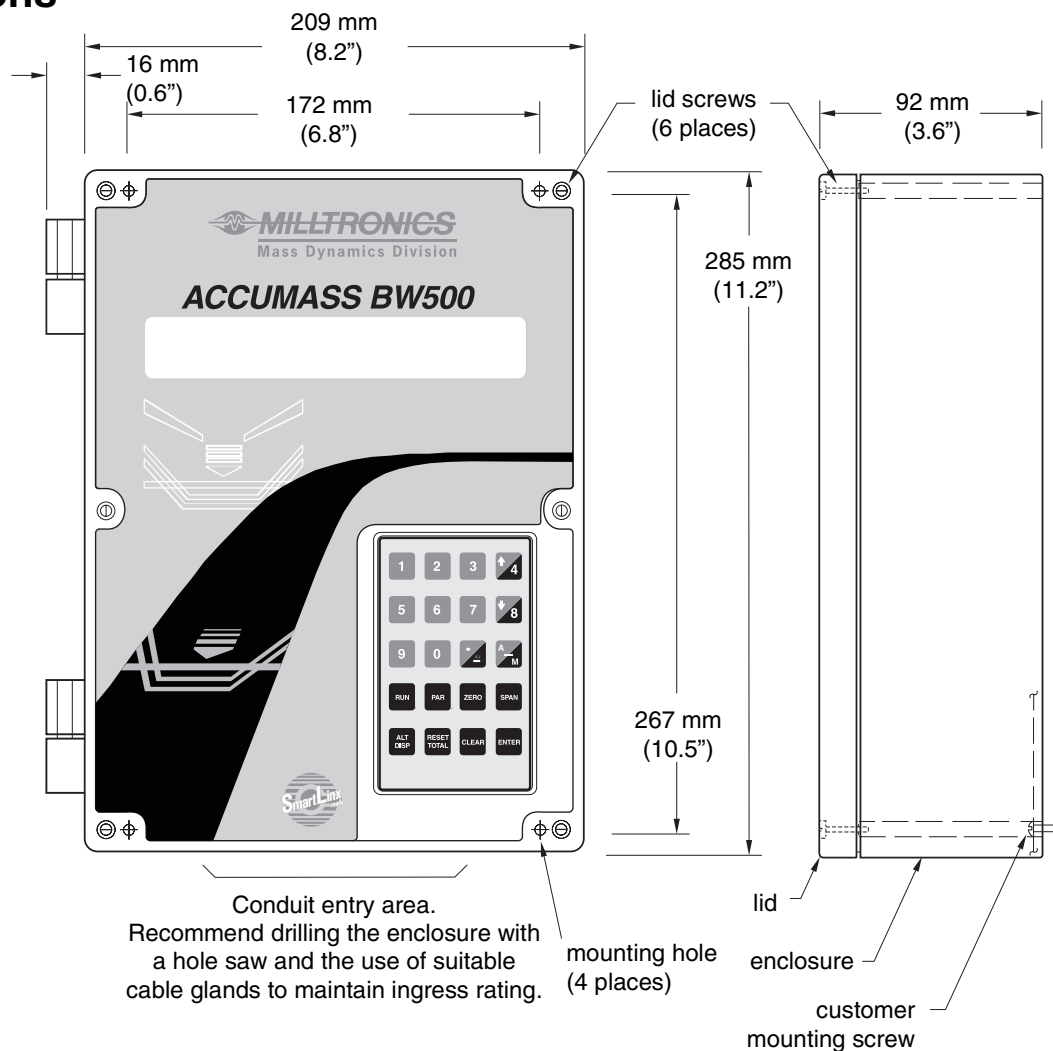
Approvals:

Installation

Notes:

1. Installation shall only be performed by qualified personnel, and in accordance with local governing regulations.
2. This product is susceptible to electrostatic shock. Follow proper grounding procedures.

Dimensions



3. Non metallic enclosure does not provide grounding between connections. Use grounding type bushings and jumpers.

Optional Plug-ins

SmartLinx® Module

The BW500 is software/hardware ready to accept the optional Milltronics SmartLinx® communications module that provides an interface to one of several popular industrial communications systems.

Your BW500 may be shipped to you without a SmartLinx® module, for installation at a later date.

If you are ready to install your SmartLinx® module, or want to change it, please follow the instructions as outlined.

Installation

1. Isolate power and voltages applied to the BW500
2. Open the lid
3. Install the module by mating the connectors and secure in place using the two screws provided.
4. Route communication cable to SmartLinx® module along the right side of the enclosure wall. This route will reduce communication.

Note:

Refer to the SmartLinx® module documentation for any required hardware settings prior to closing the lid.

5. Close the lid
6. Apply power and voltage to the BW500.

Refer to:

- SmartLinx® Module in the Specifications section on page 14,
- P750 – P769 SmartLinx® Module Specific Parameters on page 84 in this manual,
- the SmartLinx® manual for wiring.

mA I/O board

The BW500 is software/hardware ready to accept the optional mA I/O board. The mA I/O board provides 2 programmable 0/4-20 mA outputs, 2 programmable 0/4-20 mA inputs and a nominal 24V dc supply for loop powered devices.

Your BW500 may be shipped to you without an mA I/O board, for installation at a later date.

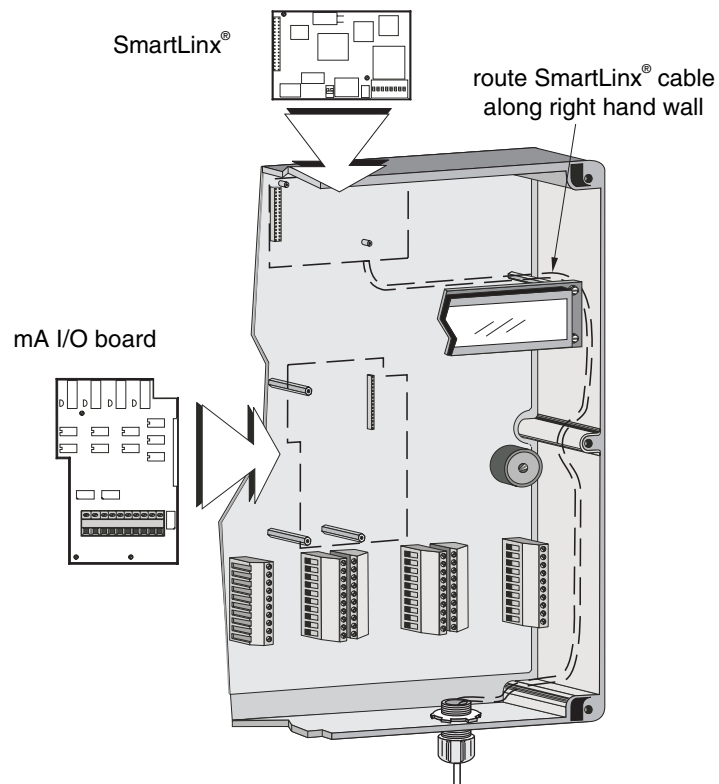
If you are ready to install your mA I/O board, please follow the instructions as outlined.

Installation

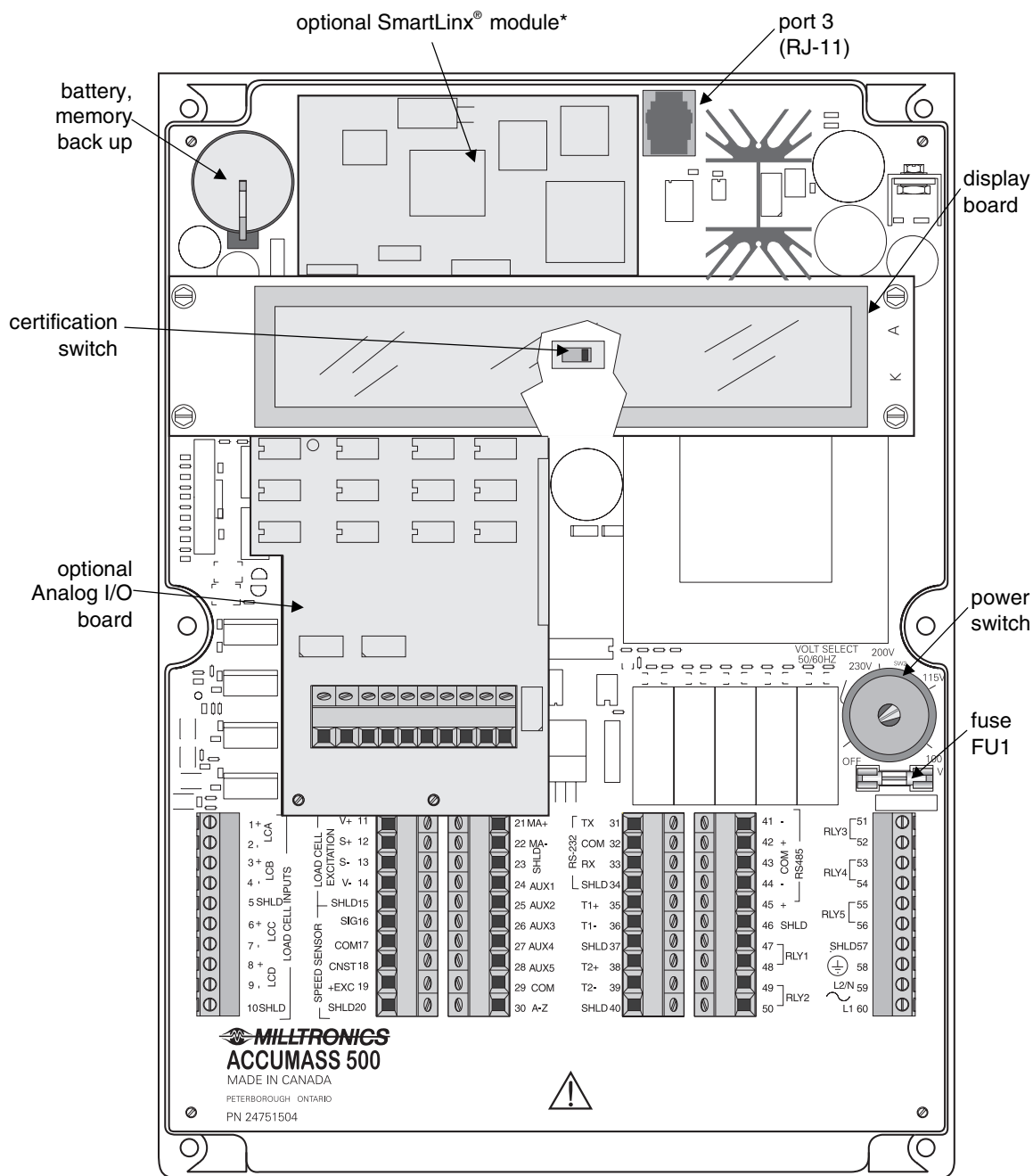
1. Isolate power and voltages applies to the BW500
2. Open the lid
3. Install the board by mating the connectors and secure the card in place using the 3 screws provided.
4. Close the lid
5. Apply power and voltage to the BW500.

Refer to:

- Specifications on page 9
- mA I/O board on page 15
- mA I/O Parameters (P200 - P220) on page 65
- mA I/O (0/4-20 mA) in the Operation section on page 91



Layout



*To reduce communication interference, route SmartLinx® cable along right side of enclosure wall.



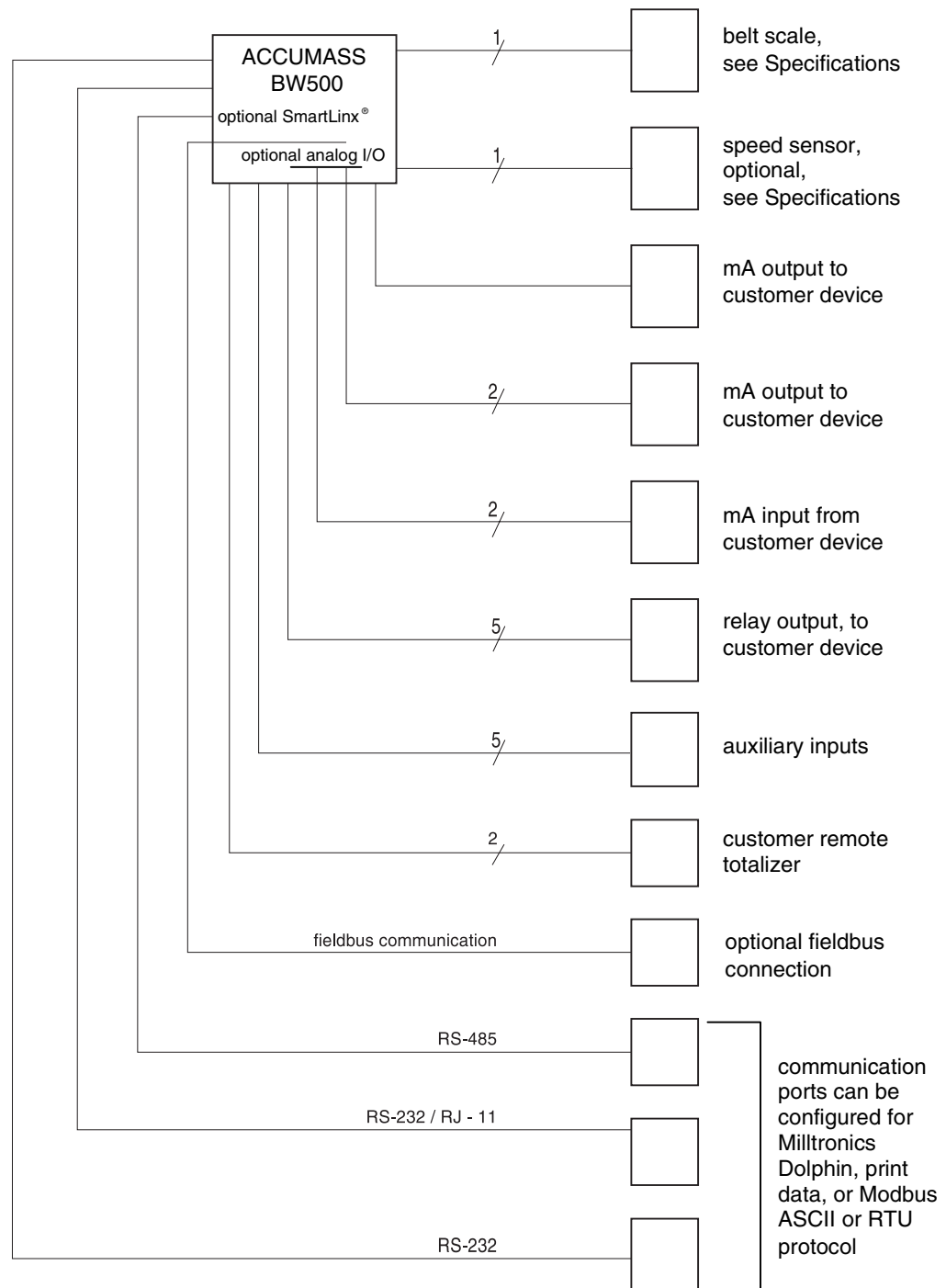
- All field wiring must have insulation suitable for at least 250 V.
- dc terminals shall be supplied from SELV source in accordance with IEC 10101-1 Annex H.
- Relay contact terminals are for use with equipment having no accessible live parts and wiring having insulation suitable for at least 250 V
- The maximum allowable working voltage between adjacent relay contact shall be 250 V.

Interconnection

Note:

Wiring may be run via common conduit. However these may not be run in the same conduit as high voltage contact or power wiring. Ground shield at one point only. Insulate at junctions to prevent inadvertant grounding.

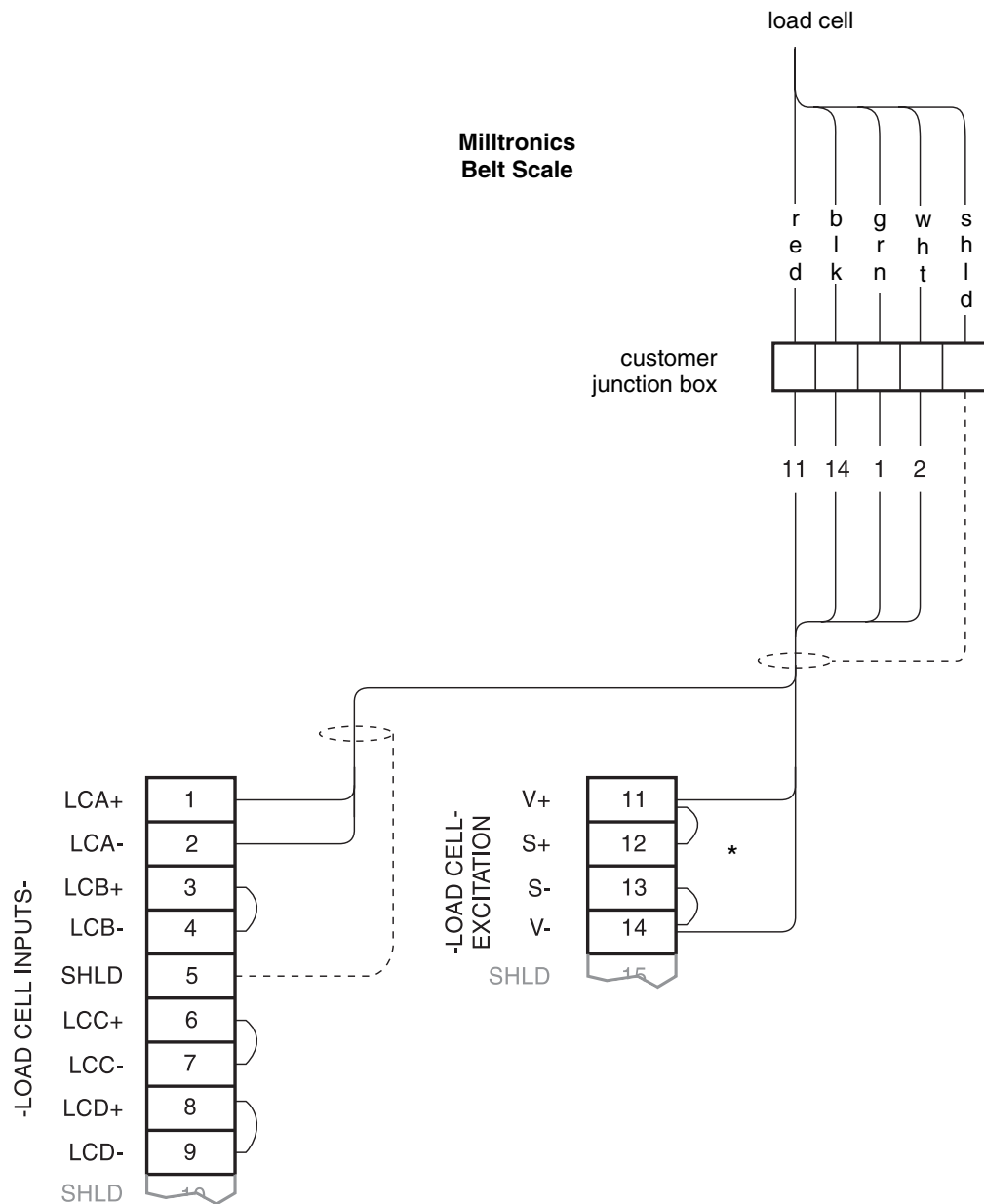
System Diagram



Note:

Typical system capability. Not all components or their maximum quantity may be required.

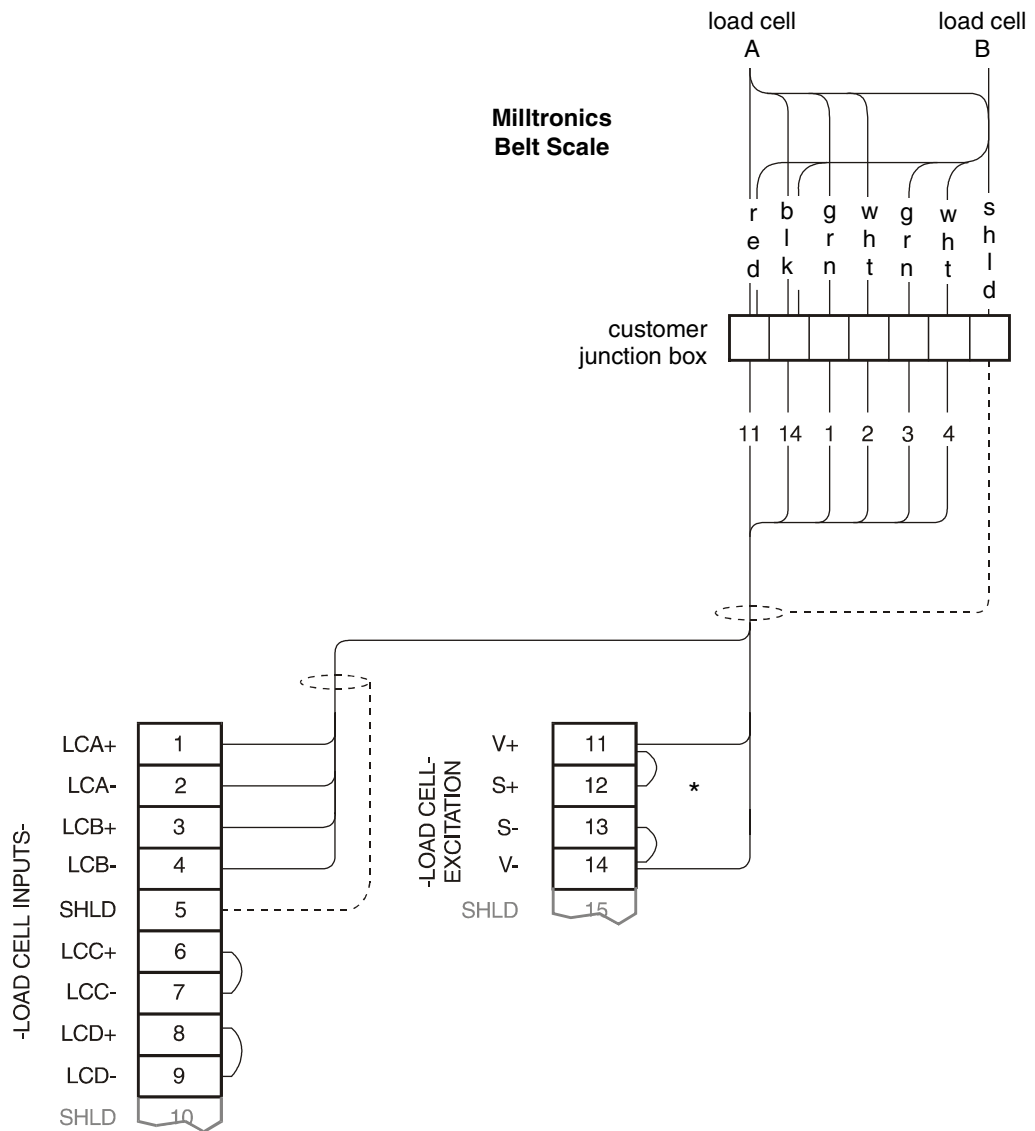
Scale – One Load Cell



*Where separation between the BW500 and belt scale exceeds 150 m (500 ft), or legal for trade certification:

- remove the jumpers BW500 terminal 11/12 and 13/14
- run additional conductors from :
BW500 terminal 12 to scale `red`
BW500 terminal 13 to scale `blk`
- If load cell wiring colours vary from those shown, or if extra wires are provided, consult Milltronics.

Scale – Two Load Cell

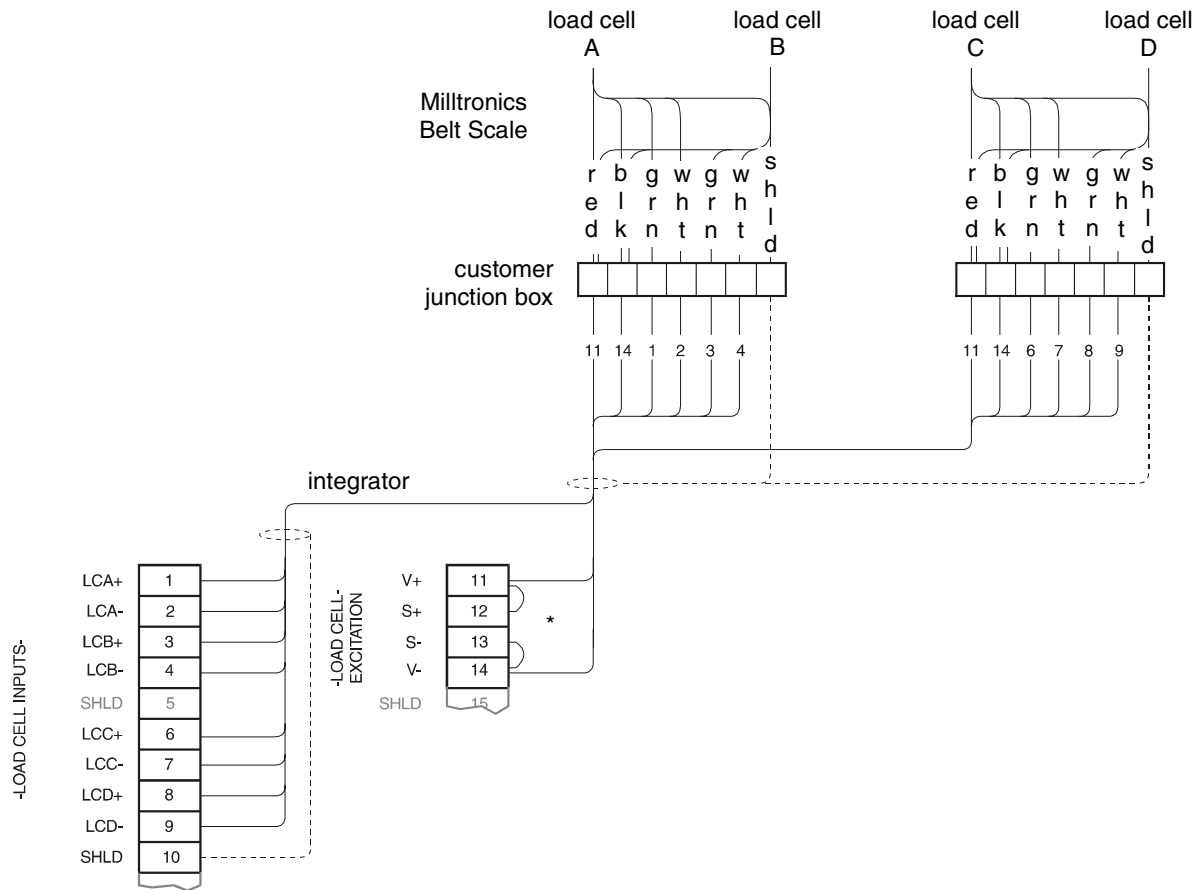


Installation

*Where separation between the BW500 and belt scale exceeds 150 m (500 ft) , or legal for trade certification:

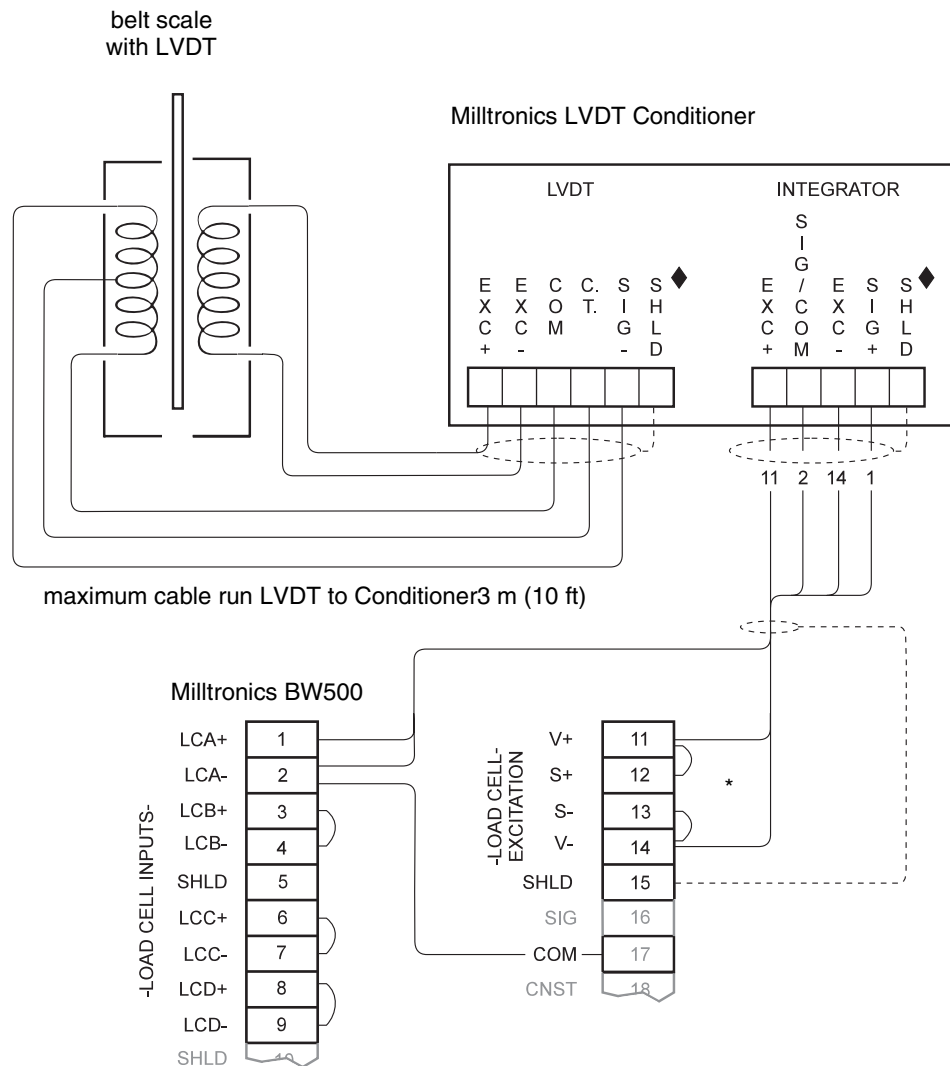
- remove the jumpers BW500 terminal 11/12 and 13/14
- run additional conductors from :
BW500 terminal 12 to scale `red`
BW500 terminal 13 to scale `blk`
- If load cell wiring colours vary from those shown, or if extra wires are provided, consult Milltronics.

Scale – Four Load Cell



- remove the jumpers BW500 terminal 11/12 and 13/14
- run additional conductors from :
BW500 terminal 12 to scale `red'
BW500 terminal 13 to scale `blk'
- If load cell wiring colours vary from those shown, or if extra wires are provided, consult Milltronics.

Scale – LVDT



*Where separation between the BW500 and LVDT conditioner exceeds 150 m (500 ft):

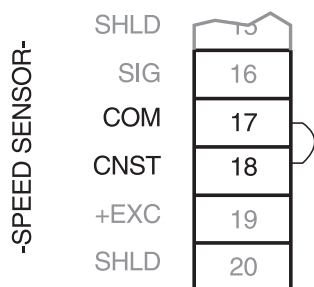
- remove the jumpers BW500 terminal 11/12 and 13/14
- run additional conductors from :
BW500 terminal 12 to integrator terminal block '+EXC'
BW500 terminal 13 to integrator terminal block '-EXC'

For further connection information on specific LVDT's consult Milltronics.

♦ Shields are common, but not grounded to chassis. Run cable shields through SHLD terminals and ground at BW500 only.

Speed

Constant Speed (No Sensor)



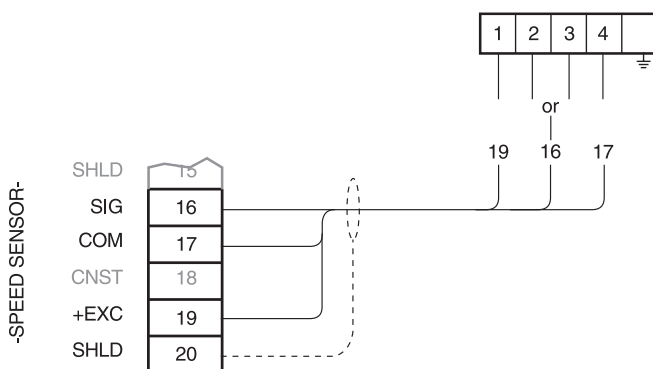
If a speed sensor is not used, a jumper or contact closure must be connected across the BW500 terminals 17 / 18 when the conveyor is running. If a speed sensor is used, insure that the jumper is removed.

Note:

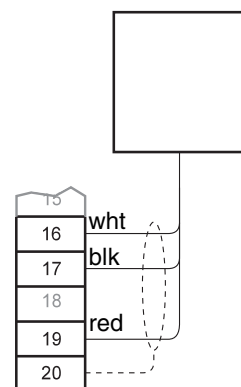
With contact closed or jumpered when the conveyor is idle, the integrator will continue totalizing.

Speed Sensor

MD Series

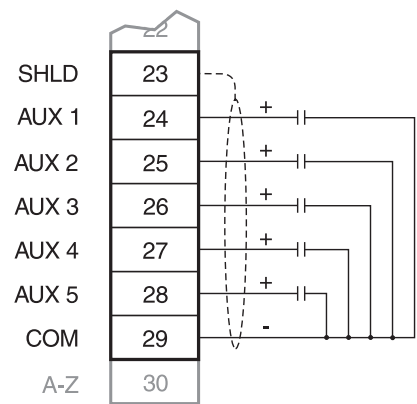


RBSS or ENCODER



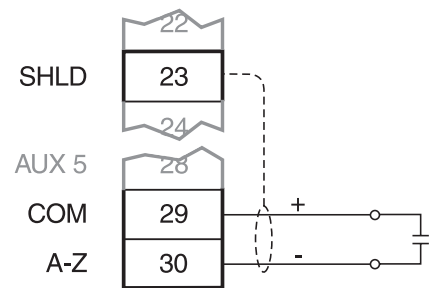
- Connect the BW500 terminal 16 to speed sensor terminal:
`2' for clockwise speed sensor shaft rotation
`3' for counter-clockwise speed sensor shaft rotation.
Speed sensor shaft rotation is viewed from the front cover of the speed sensor enclosure.
- Input device in the form of open collector transistor or dry contact across BW500 terminals 16 / 17 will also serve as a suitable speed signal.
- If a speed sensor other than the models shown is supplied, consult with Milltronics for details

Auxiliary Inputs



Customer dry contacts, or open collector transistor output supplied as required
Refer to P270 on page 67 for programming details.

Auto Zero

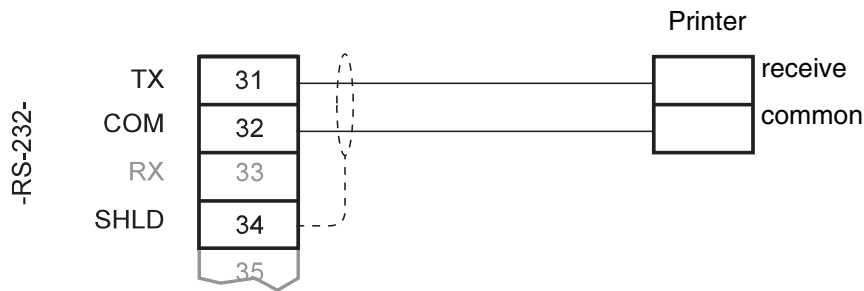


prefeed activated dry contact
Refer to Auto Zero on page 47..

Installation

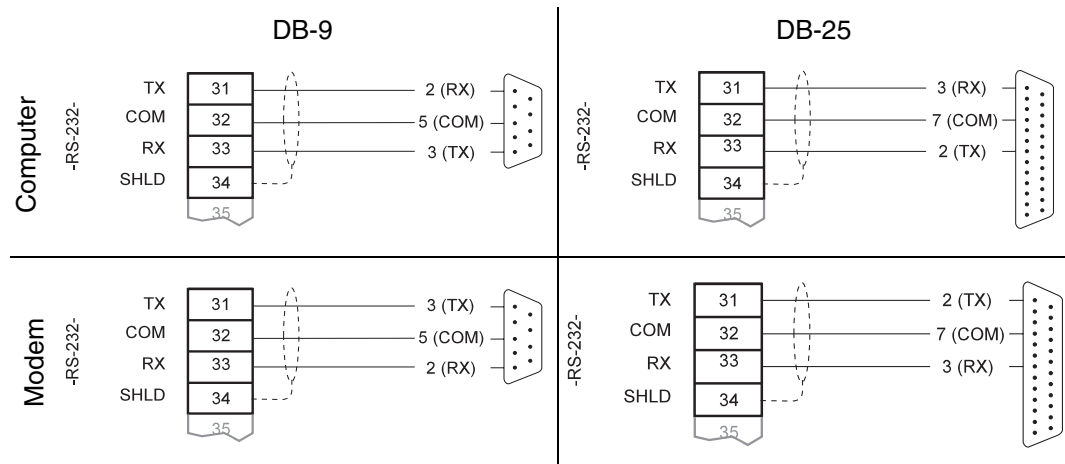
RS-232 Port 1

Printers

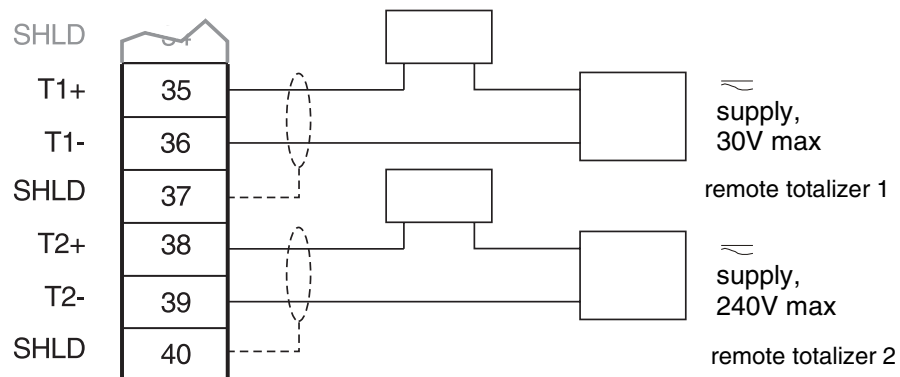


Computers and Modems

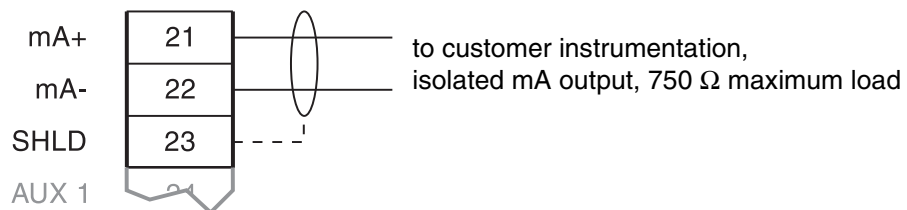
For connection to a PC compatible computer or modem, using no flow control, typical configurations are:



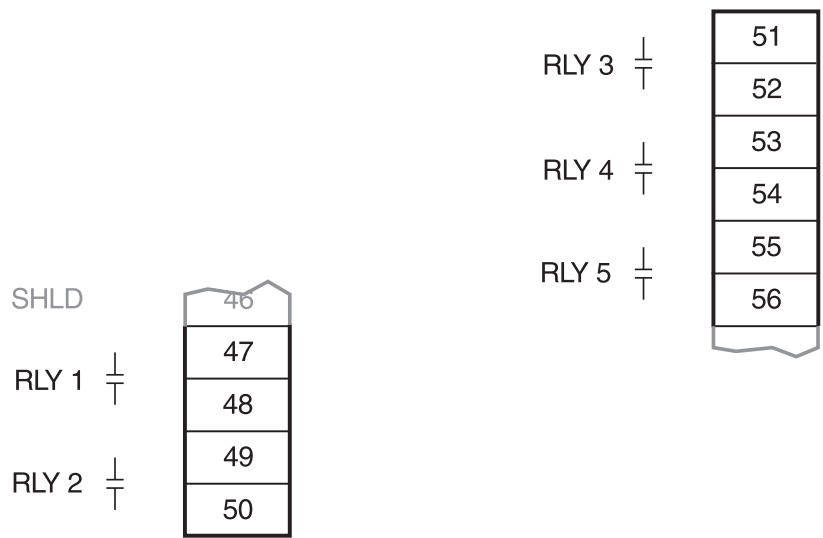
Remote Totalizer



mA Output 1



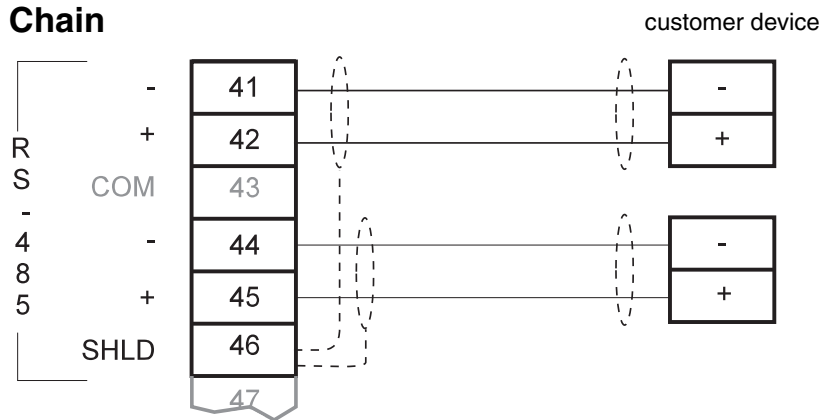
Relay Output



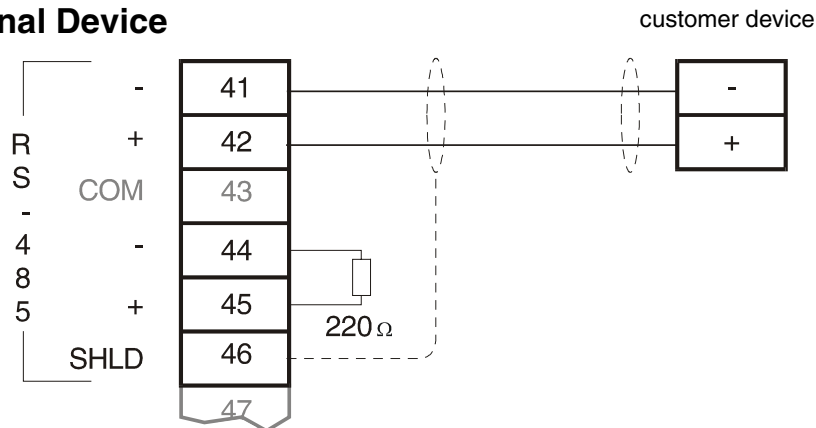
Relays shown in de-energized state, contacts normally open, rated 5 A at 250 V non-inductive

RS-485 Port 2

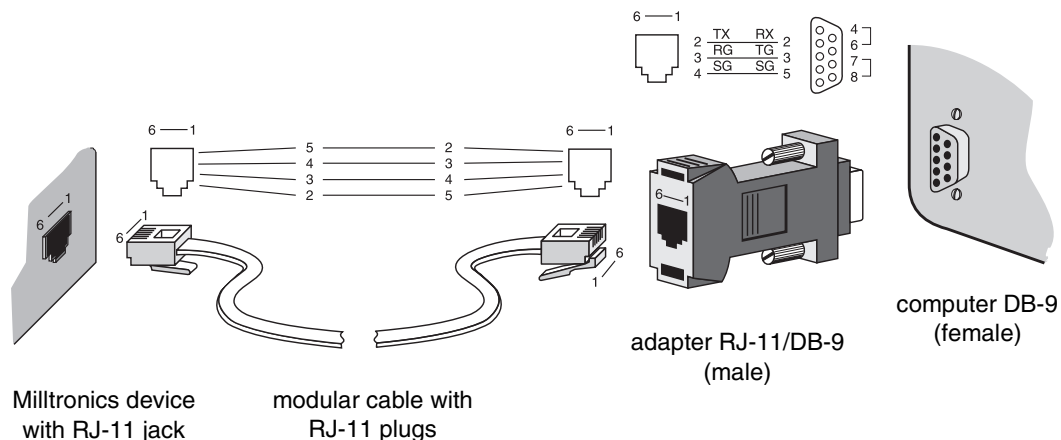
Daisy Chain



Terminal Device



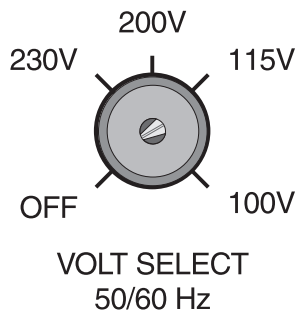
RS-232 Port 3



Note:

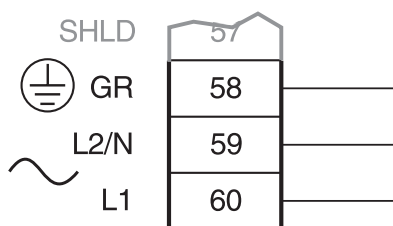
Jumper pins 4-6 and 7-8 when using hardware flow control. Otherwise, leave them open.

Power Connections



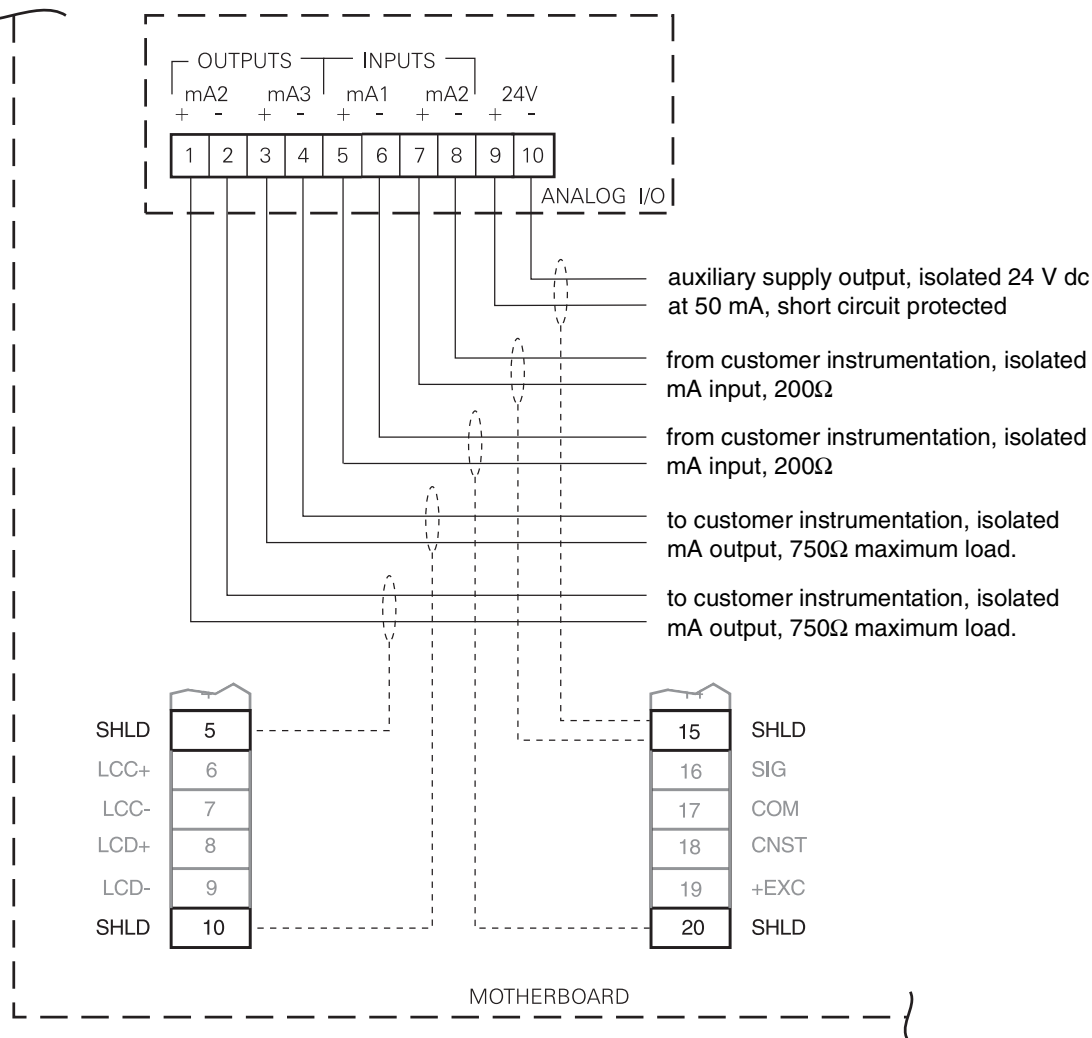
Notes:

1. The equipment must be protected by a 15 A fuse or a circuit breaker in the building installation.
2. A circuit breaker or switch in the building installation, marked as the disconnect switch, shall be in close proximity to the equipment and within easy reach of the operator.



100 / 115 / 200 / 230V
50 / 60 Hz
select voltage via switch

mA I/O Board

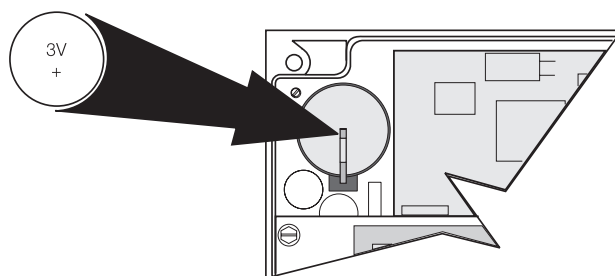


Installation

Installing/Replacing the Memory Back-up Battery



Disconnect power before installing or replacing the battery.
Do not install the memory battery until the BW500 is to be used.



The unit is supplied with one battery package (battery P/N 20200035 or Rayovac #BR2335, 3V, Lithium or equivalent). Remove the battery from the package and insert it into the battery socket.

The memory battery (see Specifications) should be replaced every 5 years to insure memory back up during lengthy power outages. An on board capacitor provides 20 minutes of charge in order to preserve the memory while the battery is being changed.

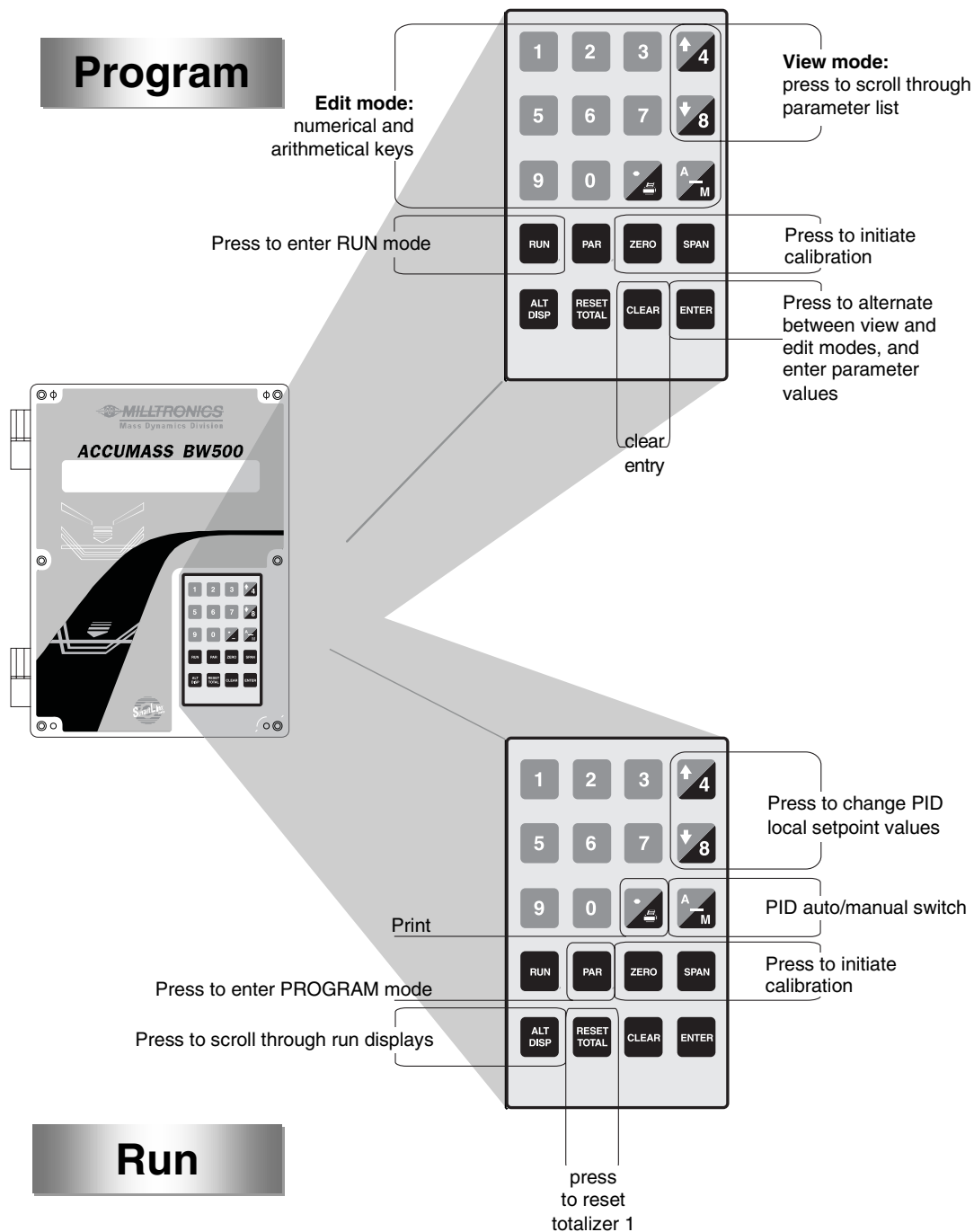
Start Up

Note:

For successful start up, insure that all related system components such as belt scale and speed sensor are properly installed and connected.

Orientation

Display and Keypad



Program Mode

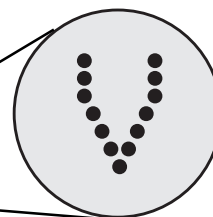
General

- The BW500 operates under two modes: 'run' and 'program'. When the unit is initially powered, it starts in the program mode
- The program parameters define the calibration and operation of the BW500.
- By entering the program mode, the user can view the parameter values or edit them to suit the application.
- The program mode display identifies the parameter by name and description and a list of options or instructions for making a valid entry.

Program Mode Display

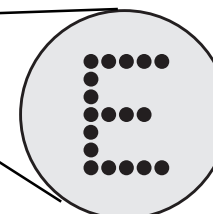
View

P001 Language	V
1-Eng	1



Edit

P001 Language	E
1-Eng	1



To enter the program mode

Press **PAR**

P001 Language	V
1-Eng	1

The default of previous parameter view is displayed.

e.g. P001 is the default parameter for initial start up.

To select a parameter

Scroll:

Press **4** to move up,

P002 Test Reference Selection	V
1-Weight, 2-Chain, 3-Ecal	1

e.g. scrolls up from P001 to P002

Press **8** to move down.

P001 Language	V
1-Eng	1

e.g. scrolls down from P002 to P001

Direct Access:

Press **PAR**

View/Edit Parameter
Enter Parameter Number

Press **0** **1** **1** **ENTER** in sequence.

P011 Design Rate: V
Enter Rate 100.00 Kg/h

e.g. access P011, design rate

Or press **9** **4** **0** **A** **2** **ENTER**

For direct access to index parameters

P940-2 Load Cell mV Signal Test V
mV reading for B 6.78

e.g. access P940-2, load cell B mV signal

To change a parameter value

P011 Design Rate: V
Enter Rate 100.00 Kg/h

from the view mode

Press **ENTER**

P011 Design Rate: E
Enter Rate 100.00 Kg/h

If edit mode is not enabled after pressing ENTER, Security is locked. Refer to Parameter Description \ Security Lock (@P000) for instructions on disabling.

Press **2** **0** **0** **ENTER**

Enter the new value

P014 Design Speed V
Enter Speed 0.08m/s

For P001 to P017, enter effects the change and scrolls to the next required parameter.

To reset a parameter value

Press **ENTER**

P011 Design Rate: E
Enter Rate 100.00 Kg/h

from the edit mode

Press **CLEAR** **ENTER**

Enter the clear function

P011 Design Rate: V
Enter Rate 0.00 kg/h

Value is reset to factory value.
e.g. 0.00 kg/h

Run Mode

In order to operate the BW500 in the run mode, the unit must undergo an initial programming to set up the base operating parameters.

Attempting to enter the run mode without satisfying the program requirements, forces the program routine to the first missing item.

Initial Start Up

Initial start up of the BW500 consists of several stages, and assumes that the physical and electrical installation of the belt scale and speed sensor, if used, is complete:

- power up
- programming
- load cell balancing
- zero and span calibration

Power Up

Upon initial power up, the BW500 displays:

P001 Language	V
1-Eng	1

The initial display prompts the user to select the preferred language

Note:
This manual only lists English as a choice of language. However, your BW500 will list the additional languages of choice, as the translated software is made available.

Programming

Press 

The BW500 then scrolls sequentially through the start up program as parameters P001 through P017 are addressed.

P002 Test Reference Selection	V
Select 1-Weight, 2-Chain, 3-Ecal	1

e.g. Accept 'weight' (supplied with scale) as the test reference.

Press 

P003 Number of Load Cells	V
Enter Number of Load Cells	2

e.g. Accept '2' as the number of load cells.

Press 

P004 Rate Measurement System	V
Select 1-Imperial, 2-Metric	2

e.g. Accept '2' for measurements in metric

Press 

P005 Design Rate Units:	V
Select: 1-t/h, 2-Kg/h, 3-Kg/min	1

e.g. Accept '1' for units in t/h

Press 

P008 Date: V
Enter YYYY-MM-DD 1999-03-19

default date

Press 

P008 Date: E
Enter YYYY-MM-DD 1999-03-19

Press           

e.g. enter current date of October 19, 1999

P009 Time: V
Enter HH-MM-SS 00-00-00

factory set time
24 hour clock

Press 

P009 Time: E
Enter HH-MM-SS 00-00-00

Press         

e.g. enter current time of 14:41

P011 Design Rate: V
Enter Rate 0.00 t/h

factory design rate

Press 

P011 Design Rate: E
Enter Rate 0.00 t/h

Press    

e.g. rate of 100 t/h

P014 Design Speed V
Enter Speed 0.00 m/s

factory design speed

Press 


P014 Design Speed E
Enter Speed 0.00 m/s

Press   

e.g. speed of 0.8 m/s

P015 Speed Constant V
Pulses/m 0.0000

e.g. speed of 0.

If the speed input is configured for constant speed, display value reads 'Jumpered', press  to advance.

Press **ENTER**

P690 Speed Constant Entry	E
1-Calculated, 2-Sensor Data	1

select:

- 1- calculated value, the program returns to P015. Enter the value from the design data sheet, or calculate per Parameter Description\P690.
- 2- sensor data, the program advances through parameters P691 and P692 prompting entry from the sensor nameplate. From this data, the speed constant is calculated and automatically entered into P015

P691 Step 1: Drive Pulley Diameter	V
Diameter	0.00 mm

P692 Step 2: Pulses per sensor Rev.	V
Enter Pulses	0.00

Press **ENTER**

P015 Speed Constant	E
Pulses/m	0.0000

Press **1** **0** **0** **.** **3** **ENTER**

e.g. speed constant of 100.3 pulses per metre

This value is obtained from the design data sheet or calculated. For manual or automatic calculation, refer to P690 on page 80

P016 Belt Length	V
Enter Length	0.000 m

factory set length

Press **ENTER**

P016 Belt Length	E
Enter Length	0.000 m

Press **2** **5** **ENTER**

e.g. belt length of 25 m

P017 Test Load: Weight MS 1	V
Enter test load	0.00 Kg/m

factory set test load

If P002 Test Load Reference had been set for 2-Chain, the display would read:

P017 Test Load: Chain MS 1
Enter test load

or if ECal

P017 Test Load: ECal MS 1
Enter test load

refer to Parameter Description\ECal Parameters (P693 – P699)

Press **ENTER**

P017 Test Load: Weight MS 1	E
Enter test load	0.00 Kg/m

Press **2** **5** **ENTER**

e.g . test load of 25 Kg/m

This value is obtained from the design data sheet

The test load value should be less than the design load (P952). If not, contact Milltronics.

P017 Test Load: Weight MS 1	V
Enter test load	25.00 Kg/m

The initial programming requirements are now satisfied. To insure proper entry of all critical parameter values, return to P002 and review parameters through to P017.

Load Cell Balancing

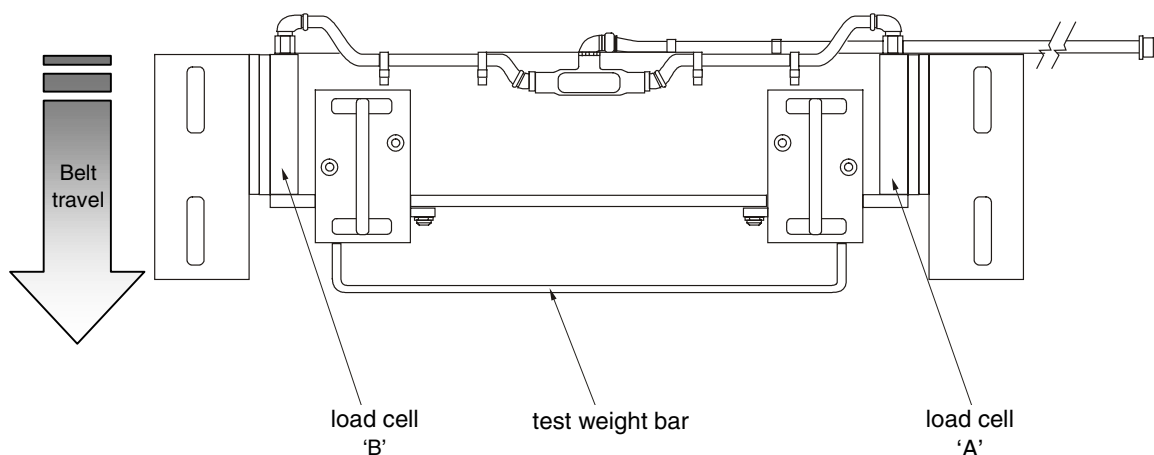
Balancing of the load cells is not required if the selected test reference is ECal (P002 = 3). In the case of ECal, the load cells are balanced by the ECal procedure.

If you are operating a two or four load cell belt scale, it is recommended that the load cells be balanced electronically prior to initial programming and calibration, or after either or both load cells have been reinstalled or replaced.

Unbalanced load cells adversely affect the performance of your belt conveyor weighing system.

With the conveyor stopped and locked out, lift the belt off the weighing idlers.

Typical two load cell belt scale



Access P295

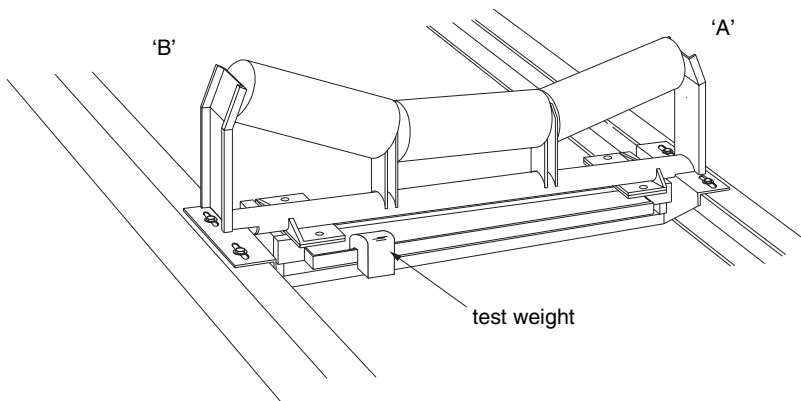
P295 Load Cell Balancing
Select: 1-A&B, 2-C&D

E
0

option '2' enabled only if P003,
number of load cells is 4

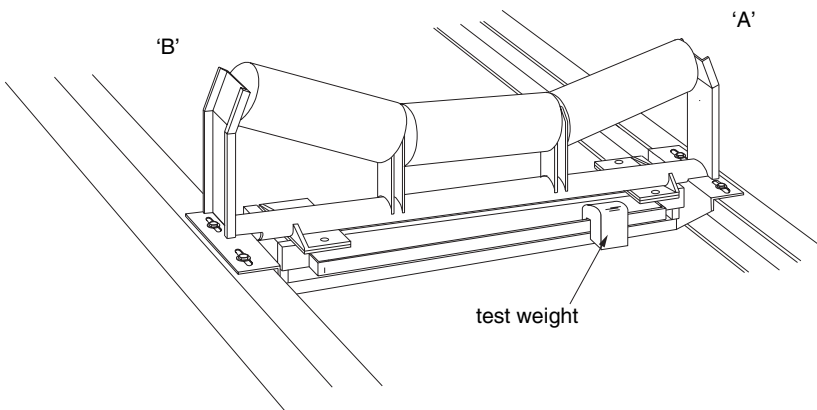
Press **1** **ENTER**

Load Cell Balancing A & B
Place weight at cell B and press ENTER.



Press **ENTER**

Load Cell Balancing A & B
Place weight at cell A and press ENTER.



Press **ENTER**

Load Cell Balancing A & B
Load cells are now balanced.

Balancing the load cells requires a
subsequent zero and span calibration.

if four load cell scale, press **ENTER** to continue

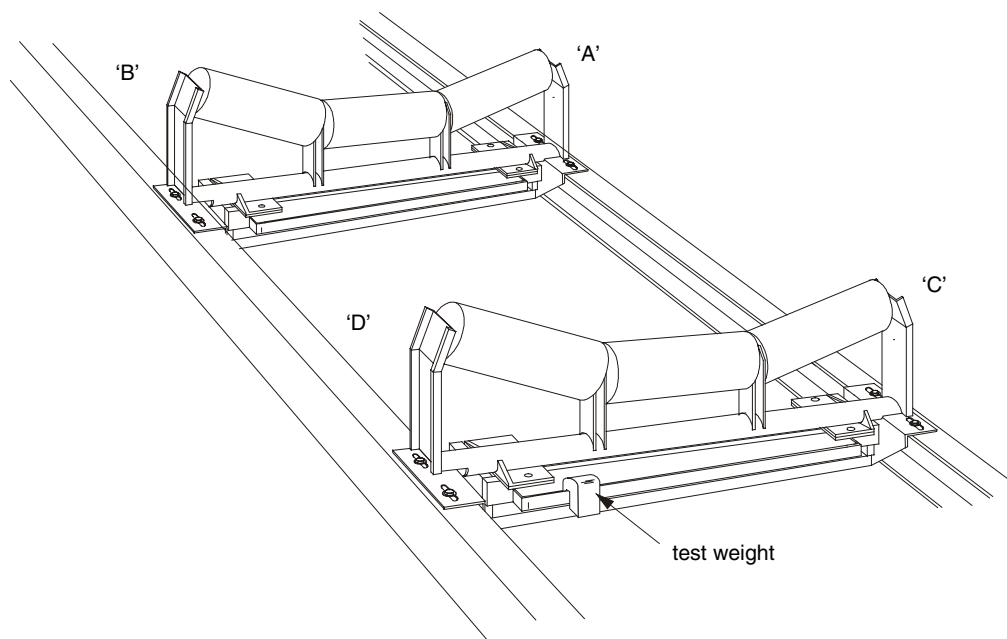
P295 Load Cell Balancing	V
Select: 1-A&B, 2-C&D	1

Press **ENTER**

Load Cell Balancing	E
Select: 1-A&B, 2-C&D	1

Press **2** **ENTER**

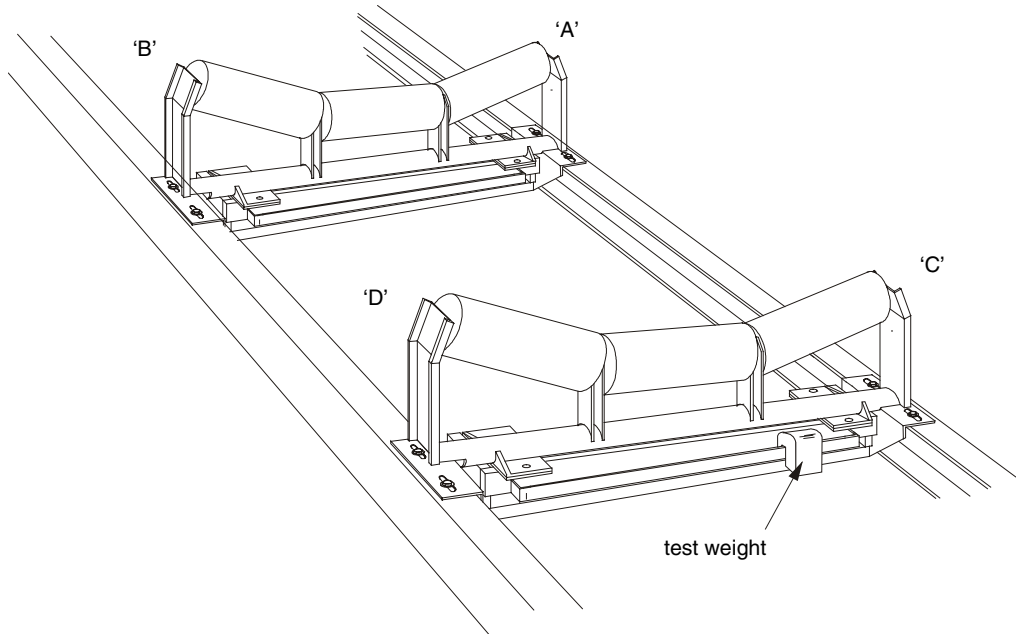
Load Cell Balancing C & D
Place weight at cell D and press ENTER.



Start Up

Press **ENTER**

Load Cell Balancing C & D
Place weight at cell C and press ENTER.



Press **ENTER**

Load Cell Balancing C & D
Loadcells are now balanced.

Balancing the load cells requires a subsequent zero and span recalibration.

Balancing of the load cells is now complete, and is followed by a zero and span calibration.

Zero Calibration

Note:

In order to obtain an accurate and successful calibration, ensure that the required criteria are met. Refer to Calibration Criteria on page 139.

Press **ZERO**

Zero Calibration. Current Zero
Clear belt. Press ENTER to Start

0 the current zero count

Press **ENTER**

Initial Zero Calibration. in progress
Current Reading: #####

the zero count being calculated while calibration is in progress.

The duration of the Zero calibration is dependent upon speed (P014),length (P016) and revolutions (P360) of the belt.

Press 

Calibration Complete. Deviation 0.00
Press ENTER to accept value: 551205

the deviation from previous zero.
For an initial zero there is no previous zero; hence the deviation is 0.

for example, the new zero count, if accepted

Press 

Zero Calibration. Current Zero 551205
Clear belt. Press ENTER to Start

for example, the current zero count of 551205

Accepting the Zero returns to start of Zero. A new Zero can be performed, or continue to Span

Span Calibration

When performing a Span Calibration where the test reference is ECal (P002 = 3), the supplied test weight or test chain must not be applied, and the conveyor must be run empty.

Note:

In order to obtain an accurate and successful calibration, ensure that the required criteria are met. Refer to Calibration Criteria on page 139.

With the conveyor stopped and locked out, apply the test weight or chain to the scale as instructed in the associate manuals; Then start the conveyor.

Press 

Span Calibration. Current Span 0
Setup test. Press ENTER to Start

the current span count

Press 

Initial Span Calibration. in progress
Current Readings: #####

the span count being calculated while calibration is in progress.

The duration of the Span calibration is dependent upon speed (P014), length (P016) and revolutions (P360) of the belt.

if

Span Count too Low.
Press CLEAR to continue.

signal from load cell too low, insure proper test weight or chain is applied during calibration

check for proper load cell wiring.

Start Up

ENTER

0.00
36790

- for example, the new span count, if accepted



36790

- for example, the current span count

Accepting the Span returns to start of Span. A new Span can be performed, or enter Run mode. If calibrating with a test weight or test chain, remove it from the scale and store in a secure place before returning to the run mode.

Run Mode

Proper programming and successful zero and span calibration allow entry into the run mode. Otherwise, entry is denied and the first missing item of programming or calibration is displayed

RUN

0.00 Kg/h
0.00 Kg

e.g. if there is no material on the belt and the conveyor is running. The current rate is 0 and no material has been totalized.

The initial programming is complete and the BW500 is operating in the Run mode. The belt conveyor can be put into normal service. The BW500 is functioning under its initial program and calibration, reporting rate of material flow and totalizing.

If the initial entry and operation in the run mode is successful, the weighing system should undergo a recalibration by performing a series of material tests. Material tests will verify the BW500 reporting accuracy, and where inaccuracies exist, allow the system to be corrected through a manual span adjustment (P019).

Recalibration of the zero and span are ongoing requirements that must be performed routinely in order to maintain accurate reporting of rate and total.

Refer now to the Recalibration.

Recalibration

Belt Speed Compensation

In order to achieve optimum accuracy in the rate computation, the belt speed displayed must equal that of the actual belt speed. As the speeds are likely to differ, a belt speed compensation should be performed.

Run the conveyor with the belt empty.

View the belt speed.

Access

P018 Speed Adjust	V
Enter New Speed	0.60

current speed of 0.6 m/s

Stop the conveyor and measure a length of the belt; marking the forward end (start time) and the back end (stop time). Use the belt scale as the stationary reference.

Run the belt and measure the time for the belt length to pass over the scale.

$$\text{speed} = \frac{\text{belt length}}{\text{time}} \qquad \begin{matrix} \text{m or ft} \\ \text{s} \quad \text{min} \end{matrix}$$

Refer to the Start Up section on page 29 for instructions on parameter selection and changing values.

Press 

P018 Speed Adjust	E
Enter New Speed	0.60

e.g. current speed of 0.6 m/s

Press     

e.g. enter correct speed of 0.63 m/s

P015 Speed Constant	V
Pulses/m	97.5169

speed sensor constant,
adjusts for P015

If

P014 Design Speed	V
Enter Speed	0.63 m/s

for constant speed (jumper),
adjusts P014

The displayed speed (used in the rate computation) now equals the actual speed.

Recalibration

Material Tests

Material tests are performed to verify the accuracy of the span calibration and compensate for the belt effects to material loading. If the material tests indicate a repeatable deviation exists, a manual span adjust (P019) is then performed. This procedure automatically alters the span calibration and adjusts the test load (P17) value, yielding more accurate span recalibrations.

If the span adjust value is within the accuracy requirements of the weighing system, the material test was successful and normal operation can be resumed.

If the span adjust value is not acceptable, repeat the material test to verify repeatability. If the result of the second material test differs considerably, consult Milltronics or their agent.

If the span adjust values are significant and repeatable, perform a manual span adjust:

Note:



Test weights are NOT used during material tests.


There are two methods of executing the manual span adjust: *% Change* and *Material Test*

- *% Change*: based on the material test, the difference between the actual weight of material and the weight reported by the BW500 is calculated and entered into P019 as % change.
- *Material Test*: based on material test, the actual weight of material is entered into P019

The method of execution is a matter of preference or convenience, and either way yields the same result.

% Change

- Run the belt empty.
- Perform a zero calibration.
Put the BW500 into run mode
Record the BW500 total as the start value _____ 
Run material at a minimum of 50% of design rate over the belt scale for a minimum of 5 minutes.
Stop the material feed and run the conveyor empty.
Record the BW500 total as the stop value _____ 
Subtract the start value from the stop value to determine the BW500 total
- Weigh the material sample if not already known.

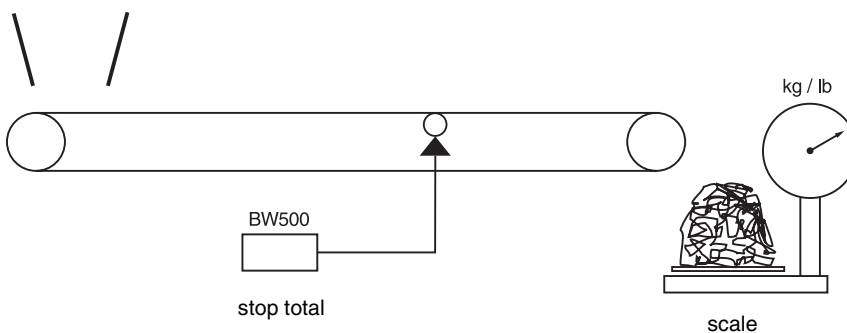
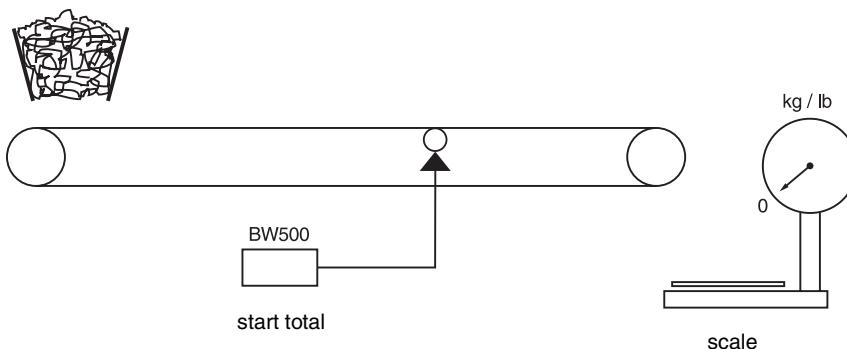
BW500 total = _____ 

material sample weight = _____ 

Calculate the span adjust value:

% span adjust =

$$\frac{\text{BW500} - \text{material sample weight} \times 100}{\text{material sample weight}}$$



Access

P019 Manual Span Adjust	E
Select 1-X Change 2-Material Test	0

Press **1** **ENTER**

P598 Span Adjust Percentage	V
Enter Calculated +/- error	0.00

Press **ENTER**

P598 Span Adjust Percentage	E
Enter Calculated +/- error	0.00

Press **A** **1** **3** **ENTER**

if % change is negative, remember to enter the minus sign, e.g. -1.3

P017 Test Load Weight: MS1	V
Enter Test Load	56.78

e.g. the new test load value is displayed

Material Test

Access

P019 Manual Span Adjust	E
Select 1-% Change 2-Material Test	0

Press **2** **ENTER**

Material Test
Add to Totalizer 0-No, 1-Yes

if yes, the weight of the material test will be added to the totalizer, if no, material is added to test totalizer (4) only.

Press **0** **ENTER**

e.g. do not add weight of material test to totalizer

Material Test
Press ENTER to start

Press **ENTER**

Material Test	#. ###
Press ENTER key to stop	

the totalizer reading as the material test is run

Press **ENTER**

Material Test	964.032
Enter actual amount	

for example, the weight totalized by the belt scale and BW500

Press **9** **7** **5** **÷** **6** **3** **3** **ENTER**

for example, 975.633 kg is the actual weight of the material test.

Material Test Deviation	-1.19
Accept 0-No, 1-Yes:	

for example, the calculated deviation is displayed as a % of the actual weight

Press **1** **ENTER**

P017 Test Load Weight: MS1	V
Enter Test Load	56.78

e.g. the new test load value is displayed

Verify the results of the span adjust by material test or return to normal operation.

Design Changes

Where parameters have been changed with a resultant impact on the calibration, they do not take effect until a recalibration is done.

If significant changes have been made, an initial zero (P377) and/or initial span (P388) may be required.

Recalibration


In order to maintain the accuracy of the weighing system, periodic zero and span recalibration is required. Recalibration requirements are highly dependent upon the severity of the application. Perform frequent checks initially, then as time and experience dictate, the frequency of these checks may be reduced. Record deviations for reference.

The displayed deviations are referenced to the previous zero or span calibration. Deviations are continuously tallied for successive zero and span calibrations, and when exceed their limit, indicate an error messages that the deviation or calibration is out of range.

Routine Zero


Note:

In order to obtain an accurate and successful calibration, ensure that the required criteria are met. Refer to Calibration Criteria on page 139.

Press 

Zero Calibration. Current Zero 551205
Clear belt. Press ENTER to start

for example, the current zero count

Press 

Zero Calibration in progress
Current Readings: 0.01 kg/m

for example, the load reported while calibration is in progress

Calibration complete. Deviation 0.02
Press ENTER to accept value 551418

for example, the calculated deviation in % of full span

for example, the new zero count, if accepted

if


Calibration is out of range
Deviation report: 403.37

if unacceptable, press  to restart.

Indication that the mechanical system is errant. The use of P377, initial zero, should be used judiciously and only after a thorough mechanical investigation has been exercised.

The cause of the increased deviation must be found and rectified. A zero recalibration as previously described can then be retried.

If the operator deems this deviation to be acceptable, set P377 to 1 to invoke an initial zero calibration. Further deviation limits are now based on this new initial zero.

Press 

Zero Calibration. Current Zero 551418
Clear belt. Press ENTER to start

e.g. zero calibration is accepted and displayed as the current zero.

Note:

End of Zero Calibration. Proceed with Span Recalibration or return to Run.

Initial Zero

Note:

An initial zero can be performed if deemed as a proper response to a 'zero calibration is out of range' message.

Access

P377 Initial Zero	E
Enter 1 to start Initial Zero	0

Press **1** **ENTER**

Zero Calibration. Current Zero	530560
Clear belt. Press ENTER to start	

for example, the current zero

Press **ENTER**

Initial Zero Calibration in progress	
Current Readings:	*****

the zero count being calculated while calibration is in progress

Calibration complete. Deviation	0.00
Press ENTER to accept value	551413

for example, the deviation from the previous zero.
for example, the new zero count if accepted

Press **ENTER**

If unacceptable, press **CLEAR** to restart.

Zero Calibration. Current Zero	551413
Clear belt. Press ENTER to start	

for example, the current zero count

Note:

End of zero calibration. Proceed with span recalibration or return to run.

Direct Zero

Notes:

1. Direct zero entry (P367) is intended for use when replacing software or hardware, and it is not convenient to perform an initial zero at that time.
2. A record of the last zero count is required.

Access

P367 Direct Zero Entry	E
Enter Zero Count	0

Press **5** **5** **1** **4** **0** **1** **ENTER**

P367 Direct Zero Entry	V
Enter Zero Count	551401

for example, the last valid zero count

Auto Zero

The Auto Zero function provides automatic zero calibration in the Run mode under the following conditions.

- the auto zero input (terminals 29/30) is in a closed state; jumper or remote contact
- the load on the belt is less than $\pm 2\%$ of the design load (P952)
- the terminal and load status coincide for at least one belt revolution

The rate display is interrupted by the Auto Zero routine

Zero Calibration is progress	
Current Reading:	0.00 Kg/m

Calibration Complete. Deviation	0.0
Auto-Zero value	551410

e.g. typical zero and deviation values

The duration of the auto zero is one or more belt revolutions (P360). If either condition is interrupted during that period, the auto zero is aborted and the run display is resumed. After one belt revolution, another auto zero will be attempted if the input and load conditions are met.

If the resulting zero deviation is less than an accumulated 2% from the last operator initiated zero, the auto zero is accepted.

If the deviation is greater than an accumulated 2%, an error message is displayed. The error message is cleared after five seconds, however if a relay is programmed for diagnostics, it remains in alarm so long as the Auto Zero conditions are being met.

If material feed resumes during an auto zero function, the totalizing function is maintained.

Routine Span

Note:

In order to obtain an accurate and successful calibration, ensure that the required criteria are met. Refer to Calibration Criteria on page 139.

Press **SPAN**

Span Calibration. Current Span	41285
Setup test. Press ENTER to start	

for example, the current span count

if

Zero should be done prior to Span Setup test. Press Enter to start.
--

do a zero calibration or press **CLEAR**

Press **ENTER**

Span Calibration in progress
Current Readings: 56.56 kg/m

the load reported while calibration is in progress.

Calibration complete. Deviation 0.03
Press ENTER to accept value 41440

for example, the deviation from the previous span

for example, the new span count, if accepted

if

Span Count too Low.
Press Clear to continue.

If unacceptable, press **CLEAR** to restart.

signal from load cell too low, insure proper test weight or chain is applied during span

check for proper load cell wiring

Calibration aborted
Belt speed is too low:

Calibration is out of range
Deviation Error:

Indication that the mechanical system is errant. The use of P388, initial span, should be used judiciously and only after a thorough mechanical investigation has been exercised.

The cause of the increased deviation must be found and rectified. A span recalibration as previously described can then be retried.

If the operator deems this deviation to be acceptable, set P388 to 1 to invoke an initial span calibration. Further deviation limits are now based on this new initial span.

Press **ENTER**

Span Calibration. Current Span 4144
Setup test. Press ENTER to start

e.g. span calibration is accepted and displayed as the current value.

Note:

End of span calibration. Remove the test weight and return to run.

Initial Span

Note:
An initial span can be performed if deemed as a proper response to a calibration out of range.

A zero calibration should be performed prior to performing a span calibration.

Access

P388-01 Initial SpanE
Enter 1 to start Initial Span0

Press 1ENTER

Span Calibration. Current Span41440
Setup test. Press ENTER to start

for example, the current span count

If

Zero should be done prior to Span
Setup test. Press enter to start

do a zero calibration or clear

Press ENTER

Initial Span Calibration in progress
Current Reading:#####

the span count being calculated while calibration is in progress.

Calibration complete. Deviation0.00
Press ENTER to accept value41900

the deviation is reset

for example, the new span value if accepted

if unacceptable, press CLEAR to restart.

Press ENTER

Span Calibration. Current Span41900
Setup test. Press ENTER to start

for example, the current span count

Note:
End of span calibration. Remove the test weight and return to run.

Recalibration

Direct Span

Notes:

1. Direct span entry (P368) is intended for use when replacing software or hardware, and it is not convenient to perform an initial span at that time.
2. A record of the last span count is required.

Access

P368 Direct Span Entry	E
Enter Span Count	0

Press       

for example, the last valid span count

P368 Direct Span Entry	V
Enter Span Count	4190

Multispan

The BW500 offers a multispan function, which allows the BW500 to be calibrated for up to eight different feed conditions that would produce varying load characteristics. Different feed conditions are typically related to the running of different materials or multiple feed locations. The varying load characteristic often has a bearing on the belt tension, and is observed especially when in close proximity to the scale. To accommodate such scale applications, a span correction can be made by selecting and applying the appropriate span.

Since every material has its own unique physical properties, and may load the belt differently, a span calibration may be required for each material in order to realize maximum accuracy.

In the case of different feeder locations, a span calibration may be required to match each feedpoint or combination of feedpoints.

Each time one of the eight conditions is in effect, the corresponding multispan is selected prior to putting the BW500 into the run mode. The selection is made by either changing the multispan operation number, accessed via P365, or by external contacts connected to the Auxiliary input, and programmed via P270.

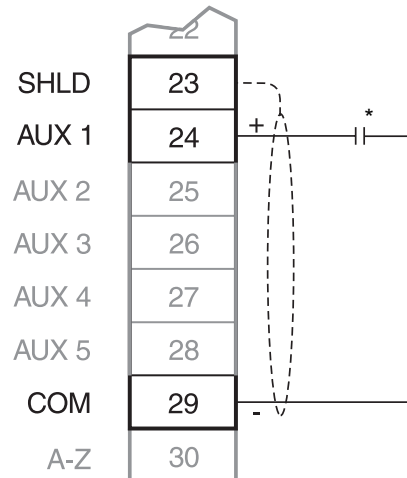
In order to enable multispan operation, the following must be addressed.

- connection
- programming
- calibration
- operation

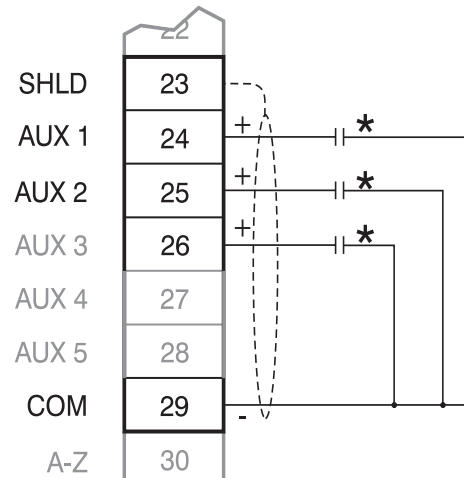
Connections

If the span selection is to be done by remote contact, the following connections would apply. Otherwise, no additional connections to the BW500 are required.

Multispan Selection of Spans 1 and 2



Multispan Selection of Spans 1 to 8



*Remote contact can be from relay or open collector switch.

Programming

Access

P365 Multispan	E
Select [1-8]	0

Span 1 will have already been done as part of the Start Up and initial calibration. Therefore, select 2.

Access

P017 Test Load: Weight MS2	E
Enter test load	0

Enter the test load value, and press **SPAN** to do a span calibration.

If it is desired to do a span calibration for another condition, (i.e. span 3 to 8), access P365 and repeat these steps for each condition. However as with any initial span, it is recommended that the span calibration for each multispan be followed by a material test and factoring.

If remote span selection is desired, Auxiliary Inputs, 1 and/or 2 and/or 3, must be programmed in order to read the contact state as the span selection. Remote selection overrides keypad (or Dolphin Plus) selection. The auxiliary inputs override the key pad selection.

Access

P270-01 Auxiliary Input Function	E
Select Function [0-13]	0

Enter **6** . This programs Auxiliary Input 1 (terminal 24) to read the contact state for span selections: 1 or 2.

If spans 3 and/or 4 are to be used:

Access

P270-02 Auxiliary Input Function	E
Select Function [0-13]	0

Enter **6** . This programs Auxiliary Input 2 (terminal 25), in conjunction with Auxiliary input 1 to read the contact state for span selections 3 and 4.

If spans 5, 6, 7, and/or 8 are to be used:

Access

P270-03 Auxiliary Input Function	E
Select Function [0-13]	0

Enter **6** . This programs Auxiliary Input 3 (terminal 26), in conjunction with Auxiliary input 1 and Auxiliary input 2 to read the contact state for span selections 5,6,7, and 8.

Remote selection of a span is not enabled until a span calibration has been done. Initial span selection must be done via the Multispan parameter, P365.

Initial multispan calibration or span selection is made via the Multispan parameter (P365).

Operation

When span calibration is done, press **RUN** to revert to the run mode.

Rate Kg/h	0.00 Kg/h	M32
Total 1	0.00 Kg	

multispan 2
e.g. if there is no material on the belt and the conveyor is running. The current rate is 0 and no material has been totaled.

When the material to be run on the belt changes, the multispan is changed to the corresponding span. This is completed either by changing the span value entered in P365, or by closing the appropriate contacts connected to the programmed Auxiliary inputs.

Span	Auxiliary Input Aux 1	Multispan Selection Aux 2	Multispan Selection Aux 3
1	— —	— —	— —
2	— /—	— —	— —
3	— —	— /—	— —
4	— /—	— /—	— —
5	— —	— —	— /—
6	— /—	— —	— /—
7	— —	— /—	— /—
8	— /—	— /—	— /—

It may be required to reset or note the totalizer value, as the process materials being conveyed change. Refer to Operation on page 89

Linearization applies concurrently to spans.

Factoring

In order to calculate the value of a new or unknown test weight to the current span, the factoring procedure is used.

Note:

For optimum accuracy in the factoring results, a routine zero calibration is recommended.

With the conveyor stopped and the belt empty:

Access

P359 Factoring
Select 1-Weight, 2-Chain

Press **1** **ENTER**

Factoring Weight
Place weight and press ENTER

e.g. factor the test weight

Press **ENTER**

Factoring Weight
Factoring in progress **##.## kg/m**

the load reported while factoring is in progress.

Factoring Weight
Press ENTER to accept value **45.25**

for example, the new factor, if accepted

Press **ENTER**

P017 Test Load Weight:
Enter Test Load **45.25**

for example, the current test load value
factoring is complete. return to Run mode if so desired

Note:

If multispan function is used, the test load value is stored for the current multispan only.

Linearization

Conveyor applications where the ideal belt scale location has been compromised, or where there is a high degree of variation in belt tension, typically cause the belt scale to report load non-linearly. The BW500 provides a linearizing function (P390 - P392) in order to correct for the deficiency in the weighing system and to provide an accurate report of the actual process.

To verify that the cause of the non-linearity is not mechanical:

- run the conveyor belt empty and stop it.
- Lift the belt off of the scale and suspend various test weights to the scale to verify mechanical linearity. If the load reported by the BW500 at these tests is non-linear, a mechanical problem is indicated. Refer to the belt scale manual in order to resolve the non-linearity by improved installation or repair.

If it is determined that the non-linearity is due to the weighing application, and not the actual belt scale, apply linearization by performing the following:

- zero calibration
- span calibration at 90 to 100% of design rate
- material tests at 90 to 100% of design rate
- manual span adjust if required
- material tests at 1 to 5 intermediary flow rates where compensation is required.

Note:

Compensation points must be at least 10% of the design load apart.

- calculate the percentage compensation for each flow rate tested.

$$\% \text{ compensation} = \frac{\text{actual weight} - \text{totalized weight}}{\text{totalized weight}} \times 100$$

where:

actual weight = material test

totalized weight = BW500 total

Notes:

- After the compensation has been programmed into the BW500, a material test should be run to verify the effect of linearization.
- If additional compensation is required, it must be based on new material tests performed with the linearization turned off (P390 = 0).

Example :

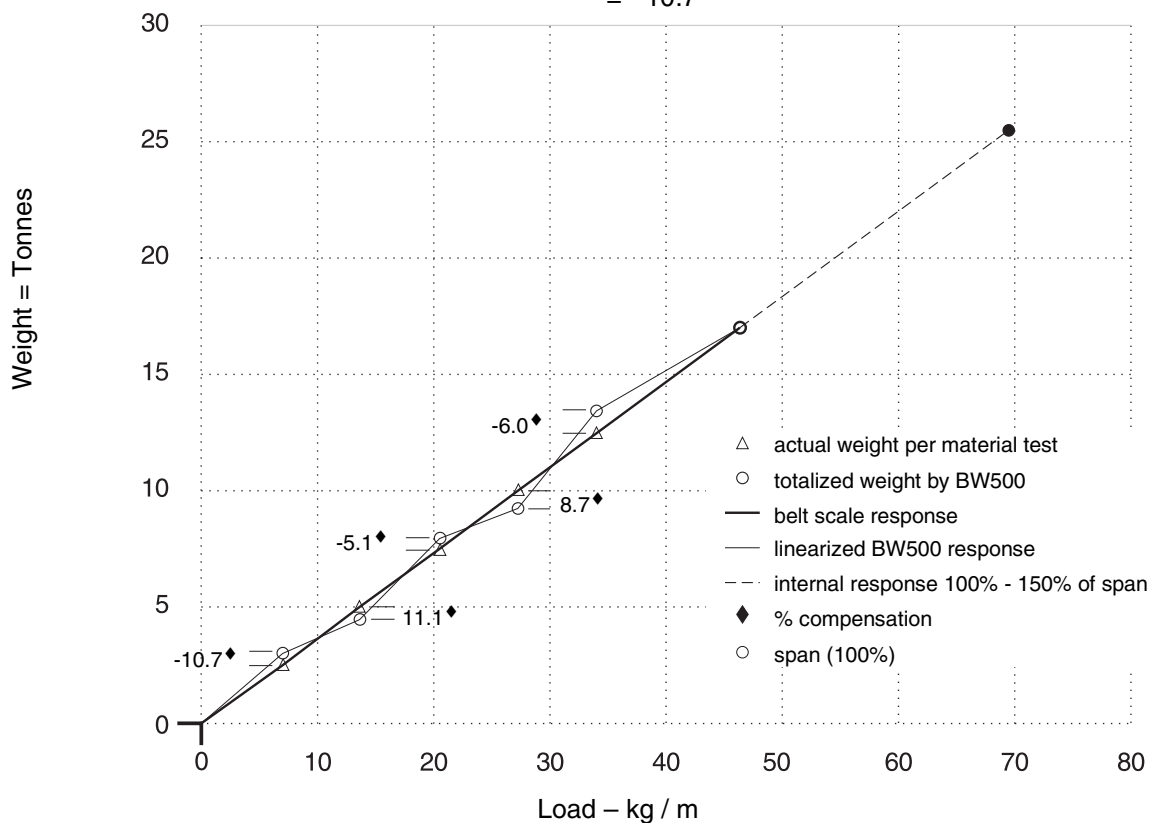
A non-linearity with respect to the ideal response exists in a belt scale application with design rate of 200 t/h. It is decided to do material tests at 15, 30, 45, 60 and 75% of the design load. After performing a zero and a span calibration at 100% of the design load, followed by material tests and manual span adjust, five material tests were performed at 30, 60, 90, 120 and 150 t/h, as indicated by the BW500. The following data was tabulated. (This example is exaggerated for emphasis).

The material tests should be run at same belt speed, representative of normal operation; in this case 1.2 m/s. For each rate, record the corresponding load value by scrolling to the BW500 load display during running conditions or by calculation.

$$\text{load} = \frac{\text{rate}}{\text{speed}}$$

BW500 load kg/m	material test tonnes	BW500 total tonnes	compensation* %
6.94	2.5	2.8	-10.7
13.89	5.0	4.5	11.1
20.83	7.5	7.9	-5.1
27.78	10.0	9.2	8.7
34.72	12.5	13.3	-6.0

*calculation example: % compensation = $\frac{2.5 - 2.8}{2.8} \times 100$
= -10.7

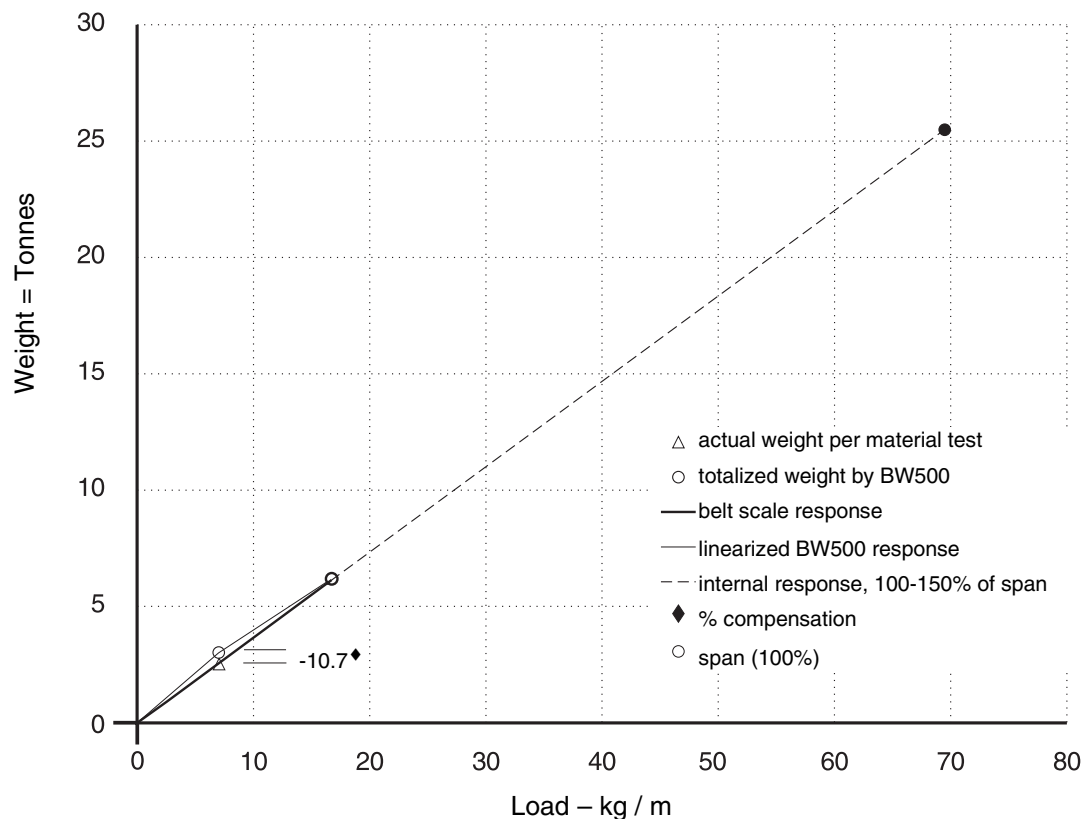


Program the BW500 as follows:

Parameter	Function
P390 = 1,	linearization – on
P391-01 = 6.94	point 1, load
P391-02 = 13.89,	point 2, load
P391-03 = 20.83	point 3, load
P391-04 = 27.78	point 4, load
P391-05 = 34.72	point 5, load
P392-01 = - 10.7	point 1, compensation
P392-02 = 11.1	point 2, compensation
P392-03 = - 5.1	point 3, compensation
P392-04 = 8.7	point 4, compensation
P392-05 = -6.0	point 5, compensation

Note:
Often only one point of compensation is required, usually at a low load value. In the prior example, if compensation was only required at 6.94 kg/m, the programming could be as follows. Compensation is optimized by establishing the next load value that agrees with the material test, hence where compensation is zero and entering it as the next compensation point.

P390 = 1	linearization on
P391-01 = 6.94	point 1, load
P391-02 = 20.00	point 2, load
P392-01 = -10.7	point 1, compensation
P392-02 = 0	point 2, compensation



Parameter Description

f indicates factory set value

P000 Security Lock

Locks out the program editor so that parameter values for P001 through P999 cannot be changed. This however does not prevent the access to the parameters for viewing.

Programming is locked out if the value of P000 is other than 1954.

entry:

1954 = unlocked^{*f*}

~~1954~~ = locked

Start Up (P001 to P017)

This is the minimum parameter programming required before attempting a calibration and successful entry into the run mode.

P001 Language

Selects the language for communication with the BW500

entry:

1 = english^f

Note:

This manual only lists English as a choice of language. However, your BW500 will list the additional languages of choice, as the translated software is made available.

P002 Test Reference Selection

Selects the type of test reference used to represent a material load: weight, chain or electronic.

weight: the weight that is supplied specific to the scale

chain: optional, sized specific to scale and conveyor

electronic: calibration based on automatic calculation of the mV span from the load cells

Entry:

1 = weight^f

2 = chain

3 = ECal

P003 Number of Load Cells

Milltronics belt scales are available in models of one, two or four load cell design. Select the number of load cells corresponding to the belt scale connected.

If using the optional remote LVDT conditioner card, for LVDT based scales, select the "1" value.

Entry:

enter the number of load cells: 1, 2^f or 4

P004 Rate Measurement System

Selects system of measurement used, either imperial or metric.

Entry:

1 = imperial

2 = metric^f

P005 Design Rate Units

Selects the units of measurement used.

imperial – P004 = 1		metric- P004 = 2
entry:	1 <i>f</i> =	T/h(tons / hour)
	2 =	t/h (tonnes / hour)
	3 =	kg/h (kilograms / hour)
	4 =	kg/min (kilograms / minute)

Changing this parameter does not affect the rate (P011), belt speed (P014) or belt length (P016) parameters. These parameters should be re-entered for conformity in units.

t = 1000 kg

LT = 2240 lb.

T = 2000 lb.

P008 Date

Enter the current date in *yyyy-mm-dd* format.

where:

yyyy = year

mm = month, 01 –12

dd = day, 01 – 31

e.g. 1999-03-19 (March 19, 1999)

P009 Time

Enter the current time in *hh-mm-ss* 24 hour format.

where:

hh = hour

mm = minute

ss = second

P011 Design Rate

Specifies the design rate of material flow for the belt scale. (*f=0.00*)

Enter the design rate from the supplied design data sheet, in the units selected (P005).

P014 Design Speed

Specifies the design speed for the conveyor belt. (*f=0.00*)

Speed units are:

feet/min if the imperial system of measurement has been selected, P004 = 1


metres/s if the metric system of measurement has been selected, P004 = 2

P015 Speed Constant

This value is used with the speed sensor frequency, to calculate the actual belt speed. ($f=0.0000$)

Entry:

If speed input is wired for constant speed (terminals 17/18 jumpered), value defaults to 'jumpered'.

If the speed input is connected to a speed sensor, press . P015 automatically jumps to P690. Refer to P690 on page 80 for speed constant entry.

P016 Belt Length

The length of the conveyor belt (one belt revolution). ($f=0.000$)

Length units are:

feet: if the imperial system of measurement has been selected, P004 = 1
metres: if the metric system of measurement has been selected, P004 = 2

Enter the belt length

P017 Test Load

The load to be referenced when performing a span. ($f=0.00$)

Load units are:

lb/ft: if the imperial system of measurement has been selected, P004 = 1
kg/m: if the metric system of measurement has been selected, P004 = 2

The display indicates the test reference as selected by P002; either: 'weight', 'chain' or 'ECal' and the multispan number MS, 1-8.

Enter the test load value

In the case of ECal, pressing enter at P017 invokes P693 for data entry. ECal sets the value for P017 at 100% of design load (P952).

P018 Speed Adjust

This parameter allows adjustment to the speed constant (P015). Initially, this parameter displays the dynamic speed of the belt. If the displayed speed is not equal to the actual speed, enter the actual belt speed. ($f=0.00$)

For speed sensor applications, the value of P015 is automatically adjusted.

For constant speed (terminals 17/18 jumpered) the value of P014 is automatically adjusted.

P019 Manual Span Adjust

Provides a means for adjustment to the span calibration. ($f=0$)

The adjustment value is determined by performing material tests and is subsequently entered either as a calculation of % change into P598, or as the weight of the material test

entry:

1 = % change

2 = material test

Refer to Recalibration on page 41.

P022 Minimum Speed Frequency

Sets the minimum frequency that the speed sensor can reliably read. Signals at low frequencies are erratic, adversely affecting the performance of the weighing system.

Entry:

1 = 1 Hz (at 1 Hz, it takes 1 s before defaulting to 0 speed)

2 = 2 Hz f (at 2 Hz, it takes 0.5 s before defaulting to 0 speed)

P080 Damping Display

P080-01 Rate

P080-02 Load

P080-03 Speed

Sets the speed of response to which the displayed readings (rate, load and speed), and outputs (alarm and mA*) react to change.

Refer to Operation on page 89.

Note:

Effect of damping (P080-01) on mA output* can be overridden by mA output damping (P220).

The higher the damping value, the slower the response.

Enter damping value, range 0.000 f – 999

*Damping is not applicable to the mA output if programmed for PID function (P201 = 4).

P081 Display Scroll Mode

The run displays are scrolled either manually by pressing ALT DISP if the scroll mode is set to off, or automatically if the mode is set to on.

entry:

0 = off f

1 = on

Relay/Alarm Function (P100 - P117)

These parameters are specific to the use of the relay/alarm function. Refer to Operation on page 89

P100 Relay Function

Sets the relay function for the relay selected, relays 1 to 5 (P100 - 01 to – 05)

Notes:

- To reset the Diagnostics relay, the BW500 must be cycled between Program and Run mode
- To reset the Batch relays, the Batch totalizer must be reset.

entry:

0 = off ^f
1 = rate
2 = load
3 = speed
4 = diagnostic
5 = PID-01 setpoint deviation*
6 = PID-02 setpoint deviation*
7 = pre-warn[▼]
8 = setpoint[▼]

*valid only if PID system (P400) is enabled

▼valid only if batch function (P560) is enabled

P101 High Alarm / Deviation Alarm

High Alarm (^f=100)

For relay functions, P100 = 1, 2 and 3, this parameter sets the high alarm setpoint for the relay selected, relays 1 to 5 (P100 - 01 to – 05)

Enter the value in % of full scale

Deviation Alarm (^f=10)

For relay functions, P100 = 5 and 6, this parameter sets the deviation setpoint for the relay selected, relays 1 to 5 (P100 - 01 to – 05)

Enter the value in % of setpoint

P102 Low Alarm

Sets the low alarm setpoint for relay selected, relays 1 to 5 (P100 - 01 to – 05). (^f=20)

Enter the value in % of full scale

Note:

Not applicable if P100 = 4, 5, 6, 7 or 8.

P107 Relay Alarms

Sets the alarm mode for the relay selected, relays 1 to 5 (P100 - 01 to – 05)

Entry:

1 = high and low ^f

2 = high only

3 = low only

Note:

Not applicable if P100 = 4, 5, 6, 7 or 8.

P117 Relay Dead Band

Sets the dead band for the relay selected, relays 1 to 5 (P100 - 01 to – 05). The dead band prevents relay chatter due to fluctuations at the high or low setpoint. (^f≠3.0)

enter the value in % of full scale, or for deviation alarm enter % of setpoint

Note:

Not applicable if P100 = 4, 7 or 8.

P118 Relay Logic

Sets the logic applied to relays to determine their open or closed state.

Power Failure

The relays on the BW500 default to normally open under power loss.

Normal Operation

In software, all relays are programmed the same way; with 'on' setpoints always indicating relay action. This parameter allows the reversal of the operation. Normally, P118 = 2 for each relay.

Reverse Operation

When P118 = 3, the operation of the indexed relay is reverse from normal.

Values

P118	Logic	Relay
2	positive logic	normally closed ^f
3	negative logic	normally open

P119**Override**

This function allows the user to simulate an alarm condition: 'on or 'off', which will override normal operation until P119 setting is returned to normal.

Values

P119	Condition	Display (alarm field)
0	normal	normal
1	alarm on	ALM #
2	alarm off	blank

mA I/O Parameters (P200 - P220)

These parameters are specific to the use of the mA output. Refer to mA Output on page 91 for details.

- mA output 1 is physically located at terminals 21/22 on the main board
- mA outputs 2 and 3, and inputs 1 and 2 are physically located on the optional mA I/O board which is mounted onto the main board.

In the case of assigning mA input and output functions to PID control, the following correlation exist:

	mA input	mA output
PID control 1	1	2
PID control 2	2	3

P200 mA Output Range

Sets the mA range for the output selected, outputs 1 to 3 (P200 - 01 to – 03).

Entry:

1 = 0 - 20 mA

2 = 4 - 20 mA ^f

P201 mA Output Function

Assigns the mA output function for the output selected, outputs 1 to 3 (P201 - 01 to – 03)

Entry:

1 = rate ^f

2 = load

3 = speed

4 = PID control output*

* valid for outputs 2 and 3, only if PID system (P400) is enabled

P204 mA Output Average

Sets the averaging period, in seconds, for the rate output for output 1 only.

The instantaneous mA values are averaged for the set period, and then the average value is output during the next period while a new average is being calculated.

Entry:

0 = off ^f

1 – 999 = averaging period

P212 mA Output Minimum

Sets the minimum mA limit for the output selected, outputs 1 to 3 (P212 - 01 to – 03). The limit sets the lower mA range (0 or 4 mA) to a minimum output value. (~~f~~=3.80)

Enter limit value, range 0 - 22

P213 mA Output Maximum

Sets the maximum mA limit for the output selected, outputs 1 to 3 (P213 - 01 to – 03). The limit sets the upper mA range (20 mA) to a maximum output value. (~~f~~=22.00)

Enter limit value, range 0 - 22

P214 4 mA Output Trim

Trims the 4 mA output level for the output selected, outputs 1 to 3 (P214 - 01 to – 03). The trim adjust the output to agree with a milliammeter or other external mA input device.

Scroll the trim value up or down

P215 20 mA Output Trim

Trims the 20 mA output level for the output selected, outputs 1 to 3 (P215 - 01 to – 03). The trim adjust the output to agree with a milliammeter or other external mA input device.

Scroll the trim value up or down

P220 mA Output Damping

Sets the damping for the output selected, outputs 1 to 3 (P220 - 01 to – 03). Damping sets the speed at which the mA output reacts to change. The greater the damping value, the slower the response. If the value is 0, the mA output assumes the damping set in P080. (~~f~~=0.000)

Enter the damping value, range 0.001 – 999

P250 mA input range

Sets the mA range for the input selected, inputs 1 to 2 (P250 - 01 to – 02).

entry:

1 = 0 - 20 mA

2 = 4 - 20 mA ~~f~~

P255 mA Input Function

Assigns the mA input function for the input selected, inputs 1 to 2 (P250 - 01 to – 02)

entry:

0 = off ^f
1 = PID setpoint
2 = PID process variable

P261 4 mA Input Trim

Trims the 4 mA input level for the input selected, inputs 1 to 2 (P250 - 01 to – 02).
The trim adjusts the input to agree with an external 4 mA source.

Follow the BW500 on line instructions to trim the input

P262 20 mA Input Trim





Trims the 20 mA input level for the input selected, inputs 1 to 2 (P250 - 01 to – 02).
The trim adjust the input to agree with an external 20 mA source.

Follow the BW500 on line instructions to trim the input

P270 Auxiliary Input Function

Selects the auxiliary input function for the input selected; inputs 1 to 5 (P270 - 01 to – 13).

























Function	Symbol	Description
alternate display:		momentary closure of the input contact causes the run display to scroll to the next display.
reset totalizer 1:		momentary closure of the input contact resets the totalizer.
zero:		momentary closure of the input contact initiates a zero calibration.
span:		momentary closure of the input contact initiates a span calibration.
print:		momentary closure of the input contact sends a print request.
multispan selection:		contact states selects the multispan (P365)*.
reset batch		momentary closure of the input contact resets the batch totalizer to zero
PID freeze		off closure suspends PID function in the freeze auto mode and holds output at last value
PID setpoint source		remote local

Function	Symbol	Description
PID mode	 	auto manual
external alarm		the input contact status is sensed off
remote communication write	 	keypad / Dolphin Plus write (program) enabled SmartLinx® / remote device write (program) enabled

Entry:

0 = off *f*
 1 = alternate display
 2 = reset totalizer 1
 3 = zero
 4 = span
 5 = print
 6 = multispans selection*
 7 = reserved
 8 = reset batch
 9 = PID freeze
 10 = PID setpoint source
 11 = PID mode
 12 = external alarm
 13 = remote communication write

*If the BW500 is programmed for multispans operation, the auxiliary input contact state determines the multispans number (equivalent to P365). Input 1 is reserved for multispans 1 and 2 selection. Input 2 is reserved for multispans 3 and 4 selection. Input 3 is reserved for multispans 5 to 8 selection.

multispans selection	auxiliary input 1	auxiliary input 2	auxiliary input 3
1			
2			
3			
4			
5			
6			
7			
8			

If an attempt is made to select a multispans that has not been zero and span calibrated, the selection request is ignored.

Notes:

- When performing a remote span, it will first perform a zero, then it will ask you to set up span test. Once loading is within $\pm 2\%$ of the design test weight, it will perform the span.
- For the print command to work, the BW500 must be in Run mode.

Calibration Parameters (P295 – 360)

P295 Load Cell Balancing

Initiates an electronic balancing of the load cell input signals. Balancing is required for belt scale models of two or four load cell design.

Refer to Start Up on page 29 for requirements and execution.

P341 Days Of Service

The cumulative days that the application device has been in service. The time is recorded once daily in a non-resettable counter. Periods of less than 24 hours. are not recorded, nor accumulated. ($f=0$)

P350 Calibration Security

This parameter provides additional security to the global lock (P000).

		zero	span	reset T1
entry:	0 = no additional security f	✓	✓	✓
	1 = in addition to P000 lock; no span.	✓	X	✓
	2 = in addition to P000; no zero, and no span.	X	X	✓
	3 = in addition to P000, no zero, no span and no totalizer 1 (T1) reset	X	X	X

P359 Factoring

Factoring is used as a method of calculating the value of the test load (P017) to a new test reference; either: weight, or chain. The task is performed only for the weight or chain relevant for the multispan selected, if applicable.

Entry:

1 = weight f

2 = chain

Refer to Recalibration on page 41 for execution of the factoring procedure

Note:

Totalization is halted during the factoring procedure, and resumed only upon return to the run mode.

P360 Calibration Duration

Sets the number of whole belt revolutions to be used during a zero or span calibration. ($f=1$)

Enter number of belt revolutions, range 1 to – 99

P365 Multispan

Select the span reference to be applied for determination of rate and totalization.

Entry:

- 1 = multispan 1 (MS1), for product or condition A f
- 2 = multispan 2 (MS2), for product or condition B
- 3 = multispan 3 (MS3), for product or condition C
- 4 = multispan 4 (MS4), for product or condition D
- 5 = multispan 5 (MS5), for product or condition E
- 6 = multispan 6 (MS6), for product or condition F
- 7 = multispan 7 (MS7), for product or condition G
- 8 = multispan 8 (MS8), for product or condition H

Refer to Multispan on page 50 and P270, Auxiliary Input Function (6) on page 67.

P367 Direct Zero Entry

Directly enters the zero reference count

Direct entry is intended for use when replacing software or hardware and it is not convenient to perform an initial zero at that time. ($f=0$)

Refer to Recalibration on page 41 for execution.

P368 Direct Span Entry

Directly enters the span reference count for the span selected, span 1 to 8 (P368-01 to -08).

Direct entry is intended for use when replacing software or hardware and it is not convenient to perform an initial span at that time. ($f=0$)

Refer to Recalibration on page 41 for execution.

P370 Zero Limit Deviation %

Sets the zero calibration deviation limit (\pm) from the last initial zero. If the accumulated deviation of successive zero calibrations exceeds the limit, the zero calibration is aborted. ($f=12.5$)

Note:

If the 'legal for trade' certification switch has been set, the zero limit is $\pm 2\%$.

Enter the maximum allowable % deviation

P377 Initial Zero

Resets the initial zero.

The initial zero is the reference zero to which all subsequent operator initiated zero calibrations are compared in determining whether they have deviated beyond the zero limit (P370). ($f=1$)

Note:

Refer to Initial Zero on page 46 for execution.

P388 Initial Span

Resets the initial span for the span selected, multispan 1 to 8 (P388-01 to –08).

The initial span is the reference to which all subsequent span calibrations are compared in determining whether they have deviated beyond an accumulated $\pm 12.5\%$ of the initial span. ($f=1$)

Note:

Refer to Initial Span on page 49 for execution.

Linearization Parameters (P390 - P392)

These parameters are used to compensate for non-linear response of the weighing system to the BW500. Refer to Linearization on page 54 for execution, and example on the use of these parameters.

Note:

In the case of multispans operation, the linearizer is applied to all spans.

P390 Linearizer

Enables or disables the linearization function.

Entry:

0 = off *f*

1 = on

P391 Linearizer Load Points

Enters the load values, in units of P017, for the point selected, points 1 to 5 (P391-01 to -05). (*f=0.00*)

P392 Linearizer Compensation %

Enters the compensation value, in percent, for the point selected, point 1 to 5 (P392-01 to -05). (*f=0.00*)

P398 Moisture

Factors out moisture component of load, rate and total for all multispans selected. The factored values are meant to report the dry mean values of the material being conveyed. (*f=0.00*)

Enter the moisture content in % weight.

Proportional Integral Derivative (PID) Control Parameters, (P400 – P418)

Note:

- Changes to P401, P402, and P414 are not immediately effected while in auto mode. Change should be made in the manual mode and are effected upon return to the auto mode.
- The PID function does not control during any of the calibration functions (eg. zero, span, factor, material test)

P400

PID System

Enables the selected PID system, systems 1 or 2 (P400 – 01 or – 02).

Entry:

0 = off *f*
1 = manual
2 = auto

P401

PID Update Time

Sets the update time (P401 – 01 or -02) for the corresponding PID system (1 or 2).

Normally the controller is updated each time the process value is updated (every 300 ms). However in unstable or slow reacting systems the controller update can be programmed to update on a multiple of the process value update. A high value can introduce instability. (*f=1*)

Entry:

1 = 300 ms
2 = 600 ms
3 = 900 ms
etc

P402

PID Process Value Source

Determines the source of the process value (P402 – 01 or – 02) for the corresponding PID system (1 or 2)

The process value is the value that the controller is trying to match with the setpoint. (*f=1*)

Enter:

1 = rate *f*
2 = load
3 = mA input 1
4 = mA input 2

P405

Proportional Term

Sets the proportional term (P405-01 or -02) for the corresponding PID system (1 or 2). (*f=0.400*)

The proportional term is the proportional gain. A gain of 1 is equivalent to a proportional band of 100%.

The proportional band is the range of deviation from the setpoint that corresponds to the full range or the control output.

Enter the proportional term 0.000 to 2.000.

P406 Integral Term

Sets the integral term (P406-01 or -02) for the corresponding PID system (1 or 2).

(f=0.200)

Enter the integral term 0.000 to 2.000.

P407 Derivative Term

Sets the derivative term (P407-01 or -02) for the corresponding PID system (1 or 2).

(f=0.050)

Enter the derivative term 0.000 to 1.000.

P408 Feed Forward Term

Sets the feed forward term (P408-01 or -02) for the corresponding PID system (1 or 2). (f=0.300)

Enter the feed forward term 0.000 to 1.000.

P410 Manual Mode Output

Displays the percentage output value (P410-01 or -02) for the corresponding PID system (1 or 2)

When the PID system is in manual, this is the value output, providing bumpless transfer when switching from manual to auto. When switching from auto to manual, this parameter is loaded with the current controlled value.

P414 Setpoint Configuration

Configures the setpoint (P414-01 or -02) for the corresponding PID system (1 or 2)

Determines the source for the PID's setpoint. If local, the setpoint value is entered into P415. The setpoint can be set from the mA input 1 or 2. The mA value is scaled to the full scale value of the process value (P402).

Entry:

0 = local *f*

1 = mA input 1*

2 = mA input 2*

* for PID-01, the setpoint source is mA input 1
for PID-02, the setpoint source is mA input 2

P415 Local Setpoint Value

Sets the local setpoint (P415-01 / 02), in engineering units, for the corresponding PID system (1 or 2) when in auto mode. For the external process variable, the setpoint is shown is %. (~~f~~=0.000)

P416 External Setpoint

Displays the external setpoint (P416-01 / 02), in engineering units, for the corresponding PID system (1 or 2). For the external process variable, the setpoint is shown is %.

If the setpoint is external (P414 = 1 or 2), then this parameter displays the setpoint value that is being input, either mA input 1 or 2.

P418 Remote Setpoint Ratio

Sets the remote setpoint ratio (P418 -01/02) for the corresponding PID system (1 or 2) when P414 = 1 or 2. (~~f~~=100)

The remote setpoint ratio scales remote setpoint input by the set percentage. A value of 100 means that the setpoint is 100% of the mA input.

Batch Control (P560 – P568)

The following parameters are specific to the use of the BW500 as a batch controller. Refer to Batch Control.

P560 Batch Mode Control

Enables the batch control function. Batch control is count up.

Entry:

0 = off *f*

1 = count up

P564 Batch Setpoint

Sets the batch total. When the amount of material delivered reaches this point, the batch relay contact opens (P100) to signal the end of the batch. (*f=0.000*)

Enter the setpoint of the units of weight selected (P005)

P566 Batch Pre-Warn

Enables or disables the pre-warn function associated with batch control, warning that the batch is nearing completion.

Entry:

0 = off *f*

1 = on

P567 Batch Pre-Warn Setpoint

Sets the setpoint for the pre-warn function (P566). When the batch reaches the setpoint, the relay contact associated with the pre-warn function (P100) closes.

(*f=0.000*)

Enter setpoint in units of weight selected (P005)

P568 Batch Pre-Act

Acts on the batch operation such that when the batch totalizer is reset, the batch total is compared to the setpoint (P564). The difference is then applied to pre-act on the setpoint for the next batch in order to improve the accuracy of the batch. The activity is internally limited to $\pm 10\%$ of the batch setpoint

Entry:

0 = off *f*

1 = Auto

2 = Manual

e.g.

	1 st batch	2 nd batch	3 rd batch
setpoint	1000	1000	1000
pre-act	1000	950	960
total	1050	990	1000

P569 Manual Batch Pre-Act Amount

Enter a value to make the setpoint relay change state at a known value lower than the setpoint (P564).

e.g. Setpoint = 1000
 Manual Pre-Act = 50

The setpoint relay will activate when the batch totalizer reaches 950.

P598 Span Adjust Percentage

Accessible only through manual span adjust (P019), when percent change (1) is selected.

Refer to % Change on page 42.

Totalization (P619 - P648)

The following parameters are specific to the use to the BW500 totalizers. Refer also to Operation \ Totalization.

P619 Totalling Dropout

This parameter sets the limit, in percent of design load, below which material rates are not totalized. (*f=3.0*)

The value of '0' is reserved to allow both negative and positive totalization.

Enter drop out value in % of design load

P631 Totalizer Resolution

This parameter sets the resolution of the totalizer selected.

Totalizers are:

- 01, totalizer 1
- 02, totalizer 2
- 03, verification totalizer
- 04, material test totalizer
- 05, batch totalizer

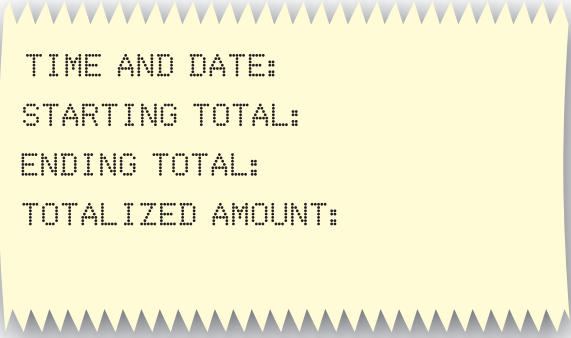
Entry:

- 1 = 0.001 (one thousandth)
- 2 = 0.01 (one hundredth)
- 3 = 0.1 (one tenth)
- 4 = 1 (unit) *f*
- 5 = 10 (x ten)
- 6 = 100 (x hundred)
- 7 = 1000 (x thousand)

P635 Verification Totalizer

Enables a dedicated internal totalizer that totals the amount of material conveyed during a zero or span verification. It is used to verify the accuracy of the scale.

If a printer is connected to a port and the required programming is in order, a printout of the activity is automatically done on completion of the verification process.



```
TIME AND DATE:  
STARTING TOTAL:  
ENDING TOTAL:  
TOTALIZED AMOUNT:
```

Entry:

0 = off, verification totalizer disabled *f*

1 = do not total, verification totalizer is enabled, but main totalizers* are disabled

2 = add total, verification totalizer is enabled as well as main totalizers*

*main totalizers consist of internal totalizers 1 and 2, and external totalizers 1 and 2

P638 External Totalizer Resolution

Note:

If the resolution selected would cause the totalizer to lag behind the count at 100% of design rate, the next possible resolution is automatically entered.

This parameter sets the resolution of the selected external totalizer.

Totalizers are:

P638-01, external totalizer 1 (T1), terminals 35/36

P638-02, external totalizer 2 (T2), terminals 38/39

Entry:

1 = 0.001 (one thousandth)

2 = 0.01 (one hundredth)

3 = 0.1 (one tenth)

4 = 1 (unit) *f*

5 = 10 (x ten)

6 = 100 (x hundred)

7 = 1000 (x thousand)

P643 External Contact Closure

Sets the duration of the contact closure, in ms, for the external totalizer selected, totalizers 1 and 2 (P643-01 or -02) (*f=30*)

Permissible values are in 10 ms increments from 0. The value is automatically calculated upon entry of P1 (design rate) and P638 (totalizer 1 resolution, external) so that the duration of contact closure allows the transistor switch response to track the total, up to 150% of the design rate. The value can be changed to suit specific contact closure requirements, such as in the case of programmable logic controllers

Note:

If the duration selected would cause the totalizer to lag behind the count rate, the next possible duration is automatically entered.

P647 Totalizer Display

Selects the totalizer combination to be displayed, either manually through the scroll display key or automatically by control of the display mode (P081).

Entry:

1 = totalizer 1 *f*

2 = totalizer 2

3 = totalizer 1 and 2

P648 Totalizer Reset, Internal

Manual reset of the selected internal totalizer when the entry is made. ($f \neq 0$)

Entry:

0 = no reset

1 = reset totalizer 2

2 = reset totalizers 1 and 2

Resetting the internal totalizers 1 and 2 resets the internal registers for external totalizers 1 and 2.

P690 Speed Constant Entry

Selects the method by which the speed constant is entered.

1 = calculated, this selection returns the program to P015 for entry of speed constant, either the value from the design data sheet

or

$\frac{\text{speed sensor pulses per revolution}^*}{\text{pulley circumference (m or ft) / revolution}}$

2 = sensor data, the selection forwards the program to P691 and P692 for entry of the required sensor data for automatic calculation. The calculated value is automatically entered into P015

P691 Drive Pulley Diameter

For speed constant entry (P690 = 2), this parameter is enabled for entry of the drive pulley diameter.

Enter the pulley diameter in the units requested, mm if P004 = 2 and inches if P004 = 1.

P692 Pulses Per Sensor Revolution

For speed constant entry (P690 = 2), this parameter is enabled for entry of the pulses per revolution that the speed sensor delivers.

Enter the pulses per revolution from the speed sensor nameplate

ECal Parameters (P693 – P698)

Accessible only through P017 for ECal test reference. After ECal completion, only a zero calibration is necessary to allow access to the run mode.

P693 Belt Scale Model

Selects the model of the belt scale connected to the BW500.

Entry:

1 = MUS

2 = MSI *f*

3 = MMI

4 = other*

*in the case of other, software jumps to P699 since data entry P694 through P698 are not applicable if P693=4

P694 ECal Load Cell Capacity

Enters the load cell's weighing capacity for the selected cell. (*f=1.0*)

-01 = load cell A

-02 = load cell B

-03 = load cell C*

-04 = load cell D*

*applicable only if P693=3

Enter the value in the units corresponding to the scale selection, e.g. in kg if P693 = 1, or lb if P693 = 2 or 3.

P695 ECal Load Cell Sensitivity

Enters the load cell's sensitivity for the selected cell. (*f=1.0*)

-01 = load cell A

-02 = load cell B

-03 = load cell C*

-04 = load cell D*

*applicable only if P693=3

Enter the value in mV/V obtained from load cell nameplate

P696 ECal Load Cell Excitation

Determines the excitation applied to the load cells. (*f=10.00*)

Nominally this value is 10 V. However, a measurement of the voltage at the load cell provides the most accurate entry.

Enter the load cell excitation in volts dc.

P697 ECal Idler Spacing

Enters the measured distance between the weighing idlers. Refer to the associated belt scale instruction manual. ($f=1.0$)

Distance units are:

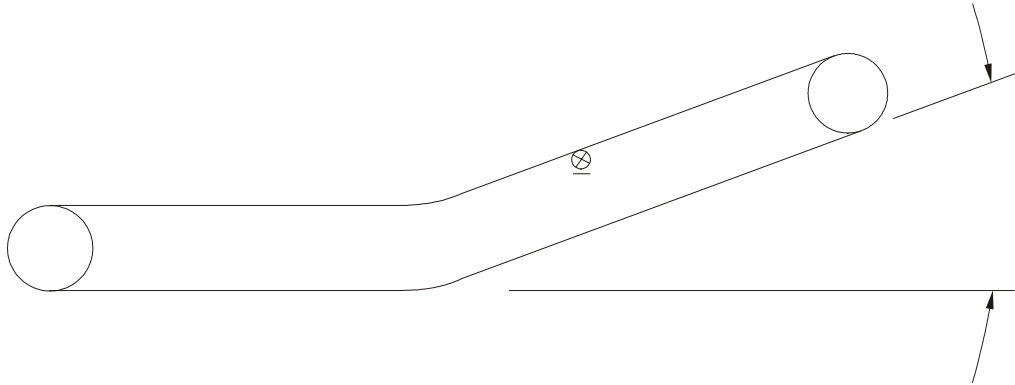
feet: if the imperial system of measurement has been selected, P004 = 1

metres: if the metric system of measurement has been selected, P004 = 2

Enter the distance to three decimal points.

P698 ECal Conveyor Inclination

Enters the inclination or declination angle of the conveyor at the point where the belt scale is installed. ($f=0.0000$)



Enter the inclination in degrees

Upon entry, display jumps to P017 to display the design load value as the test load.

P699 ECal mV Span

Applicable only for Milltronics belt scales not listed in P693, or scales other than Milltronics (P693 = 4).

Enter the mV span corresponding to 0 to 100% full scale load

Upon entry, display jumps to P017 to display the design load value as the test load.

P735 Back Light

Sets the intensity of the back light for the LCD. ($f=10$)

Entry:

0 = off

1 to 10 = low to high

P739

Time Zone

The offset from Greenwich mean time (GMT) of local time.

This parameter does not affect any timed events because all times are local. It can be accessed by a remote computer for synchronization purposes.

Enter local time zone –12 to 12

Communication (P750 - P792)

These parameters cover the various communications formats supported by the BW500: serial printer, Dolphin Plus, SmartLinx[®], and Modbus.

P750 – P769 SmartLinx[®] Module Specific Parameters

These parameters are specific to the SmartLinx[®] module installed. Refer to the module documentation for a list and description of the specific parameter requirements.

P770 – P789 Local Port Parameters

These parameters are specific to programming of the BW500 communication ports. Refer to Communications for a listing and description of these parameters.

P790 SmartLinx[®] Error Status

Displays the results of ongoing hardware tests within the communications circuitry. If any test does not meet the PASS requirements, communication halts and tests are repeated until PASS requirements are met. Communication then resumes.

P791 SmartLinx[®] Protocol Status

P792 SmartLinx[®] Error Count

Displays the number of errors.

P799 Communications Control

Assigns programming control through the local keypad (or Dolphin Plus, P770 = 1), or through a Modbus protocol (P770 = 2 or 3)

Entry:

0 = local

1 = modbus

Test and Diagnostic (P900 - P951)

These parameters are used for test and diagnostic purposes.

P900 Software Revision

Displays the EPROM (Flash ROM) software revision level.

P901 Memory Test

Tests the memory. Test is initiated by scrolling to the parameter or repeated by 'pressing enter'

Display:

PASS = normal

FAIL = consult Milltronics.

P911 mA Output Test

Tests the mA output value for the output selected, outputs 1 to 3 (P911 – 01 to -03)

Displays the value from the previous measurement. A test value can be entered and the displayed value is transmitted to the output. Upon returning to the run mode, the parameter assumes the actual mA output level. ($f=0$)

Use the up and down to scroll the value

P914 mA Input Value

Displays the current mA input value for the input selected, inputs 1 to 2 (P914 – 01 to -02).

Note:

Not applicable if mA I/O board is not connected.

P918 Speed Input Frequency

Displays the frequency of the speed input signal in Hertz.

P940 Load Cell mV Signal Test

Displays the raw (unbalanced) mV signal input for the selected load cell, load cells A to D* (P940 – 01 to – 04)

Range 0.00 - 60.00 mV.

*depending on the number of load cells selected by P003, not all load cells may be in use.

P943 Load Cell A/D Reference

Displays the A/D reference value for the selected load cells. These values are affected by load cell balancing (P295).

Load cells are:

- 01 = A and B
- 02 = C and D
- 03 = A and B plus C and D
- 04 = A
- 05 = B
- 06 = C
- 07 = D

P948 Error Log

Displays a log of the last 25 error or alarm events (P948 – 01 to – 25) that have occurred. Event 01 is the current error.

Display:

0 = no error

= error code, refer to Troubleshooting on page 137

P949 Diagnostic Error Testing

Enables or disables diagnostic error checking for memory, load cell and zero speed.

(f=0)

Entry:

0 = disable

1 = enable

Refer to Troubleshooting on page 137.

P950 Zero Register

Registers the number of zero calibrations that have been done since the last master reset. (f=0)

P951 Span Register

Registers the number of span calibrations for the span selected, span 1 to 4 (P951 - 01 to - 04), that have been done since the last master reset. (f=0)

P952 Design Load

Displays the value of the design load, which corresponds to the full scale value for alarm and mA output functions. The design load is calculated, based on the design rate and design speed. (f=0.00)

P999

Master Reset

Resets parameters and totalizers to their factory setting. (~~f~~=0)

Enter '9' to execute the reset

Operation

Load Sensing

In order for the BW500 to calculate rate and hence totalize material flow along the belt conveyor, a load signal representative of weight of material on the belt is required. The load signal is provided by the belt scale. The BW500 is compatible with belt scales fitted with one, two or four strain gauge type load cells. In order to function with LVDT type load cells, an optional LVDT conditioning card is required.

Refer to Specifications on page 9, and Installation on page 13 for belt scale requirements and connection.

Speed Sensing

In order for the BW500 to calculate rate and hence totalize material flow along the belt conveyor, a speed signal representative of belt speed is required. For optimum accuracy of the weighing system, both constant and variable speed applications, a speed sensor is required. The design speed (P014) and speed constant (P015) need to be programmed.

In constant speed applications (no speed sensor), the BW500 can be programmed to provide an internal speed signal. This is achieved by entering the design speed (P014) and providing a contact closure across speed input terminals (17/18). The speed constant (P015) defaults to 'jumpered'. This contact should change to open when the conveyor is idle to prevent errant totalization.

Refer to Specifications on page 9 and Installation on page 13 for speed sensor requirements and connection.

Modes of Operation

Run is the normal or reference mode of operation. It continuously processes the load and speed signals from the belt scale to produce internal load, speed and rate signals, which are in turn used as the basis for totalization, mA output, relay control, and communication data. The run display is programmed (P081) to scroll through rate, totalization (P647), load and speed; either manually by pressing the enter key, or automatically.

Rate
Total 1

Rate
Total 2

Load
Speed

If the BW500 is programmed for batch control, the batch display is added to the display scroll. Refer to Batch control

From the run mode, access to the program mode, and zero and span calibration is made.

The program mode allows viewing and, with security permission (P000), editing parameter values. During program, run mode functions are still active, i.e.: rate, relay, mA output and totalization.

If the program mode is left idle for a period of ten minutes, it automatically reverts to the run mode.

Zero and span calibrations effectively halt the run mode while they are in progress. During this time, totalization ceases, and all mA outputs, except for PID, fall to zero.

Damping

Damping (P080) provides control over the speed at which the displayed readings and output functions respond to changes in their respective input function; load, speed and the internal rate signals. Changes in the displayed rate of material flow, material loading and belt speed are controlled by the damping. Relay alarm functions based on input functions of rate, load and speed, respond to the damped value.

Damping consists of a first order filter applied to the signal (reading or output value), so long as the change in signal is within $\pm 10\%$ of the established reference value. If the signal deviation is greater than 10% of the reference value, the signal will jump immediately to that new value. This value will be the new reference.

For example:

A conveyor is running material at 3 t/hr. The damping value, P080 = 3, keeps the reading and associated output stable over the normal operating fluctuation; i.e. the rate varies within the filters active band, 2.7 and 3.3 t/hr. If the feed to the conveyor suffered a blockage and the rate dropped to 1.5 t/hr, the damping would be bypassed and the readings and output would immediately jump to correspond to the 1.5 t/hr rate, and establish a reference value of 1.5 t/hr. The active damping band is now set to $\pm 10\%$ about the 1.5 t/hr value, or 1.35 to 1.65 t/hr. If the blockage cleared itself slowly, i.e. the rate of increase was within the 10% active damping band; the rate readings and output would gradually increase at the damped value. The 10% band would continuously reestablish a new reference value as the rate of material progressed.

If mA damping (P220) is enabled (value other than 0), then the damping (P080) *as it pertains to the mA function* is overridden, and responds independently at the specified mA output damping rate (P220).

Note:

Damping (P080 or P220) is not applicable to the mA output when programmed for PID function (P201 = 4).

mA I/O (0/4-20 mA)

Output

The standard BW500 provides one isolated mA output. The output can be assigned (P201) to represent rate, load or speed. The output range can be set to 0 - 20 mA or 4 - 20 mA (P200). The 0 or 4 mA value corresponds to empty or zero condition, whereas the 20 mA value corresponds to the associated design value: rate (P011), load (P952) or speed (P014). The mA output can be limited for over range levels of 0 mA minimum and 22 mA maximum (P212 and P213 respectively). The output 4 and 20 mA levels can also be trimmed (P214 and 215 respectively) to agree with a milliammeter or other external mA device.

The mA output value can be tested to output a prescribed value using parameter P911. Refer to P911 on page 85.

The optional mA I/O board provides two additional mA outputs, programmable as outputs 2 and 3, using the same parameters as the standard output (1). If programmed for PID control, output 2 is assigned to PID control loop 1 and output 3 is assigned to PID control loop 2.

Input

The optional mA I/O board provides two mA inputs, programmable as inputs 1 and 2. If programmed for PID control, generally, input 1 is assigned to PID control loop 1 and input 2 is assigned to PID control loop 2.

The input range can be set to 0-20 mA or 4-20 mA (P250), and assigned a function (P255), e.g. PID setpoint. The 4 and 20 mA levels can be trimmed (P261 and P262) to agree with an external device.

Relay Output

The BW500 offers five single pole single throw (SPST) relays that can be assigned (P100) to one of the following alarm functions:

- rate: relay alarms on high and/or low material flow rate.
- load: relay alarms on high and or low belt load.
- speed: relay alarms on high and/or low belt speed.
- diagnostic: relay alarms on any error condition as it is reported.
Refer to Troubleshooting on page 137.
- PID: PID control setpoint deviation*
- batch pre-warn
- batch setpoint

*is offered only if the PID system (P400) is enabled.

For rate, load and speed alarm functions, the high and low alarm setpoints (P101 and P102 respectively) are required and must be entered in the appropriate units. The high alarm setpoint acts as the setpoint deviation alarm for relays programmed for PID setpoint deviation.

The on / off actuation at both high and low setpoints is buffered by the damping (P080) and the programmable dead band (P117), to prevent relay chatter due to fluctuations. The relay is normally energized; holding the normally open (n.o.) contact closed (can be programmed for reverse operation, P118). Upon an alarm condition, the relay is de-energized and the relay contact is opened. Once in alarm, the relay remains in alarm state until the alarm condition is removed.

Example:

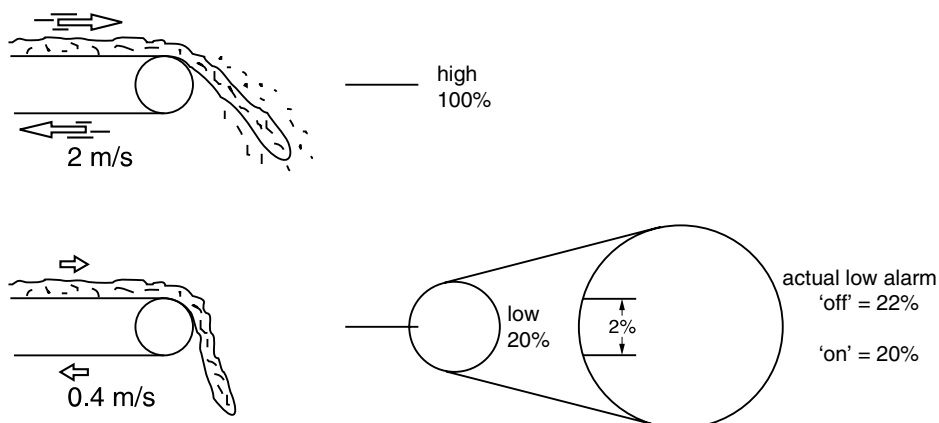
P014 = 2m/s, design speed

P100 = 3, belt speed

P101 = 100% (2 m/s)

P102 = 20% (0.4 m/s)

P117 = 2% (0.04 m/s)



alarm 'on' is with relay de-energized

Totalization

The totalization function is based on the internal rate (mass per unit time) signal proportional to belt speed and load on the associated belt scale. It is not affected by the damping function (P080). The rate signal is sampled several times a second to accurately count the mass of material conveyed. The count is held in the master totalizer used to increment the internal totalizers and to produce a pulse signal for the remote totalizers.

The BW500 provides several separate totalizer functions:

Internal totalizers:

- local display (totalizers 1 and 2)
- verification totalizer (totalizer 3)
- material test totalizer (totalizer 4)
- batch total (totalizer 5)

External totalizers

- totalizer outputs (remote totalizers 1 and 2)

To avoid totalizing material at flow rates below the low flow rate limit, the totalizer drop out limit (P619) is set to a percentage of the design load. Below this limit, totalization stops. When material flow returns to a rate above the drop out limit, totalization resumes.

Totalizer resolution or count value is set by the respective internal (P631) and external (P638) totalizer* resolution parameters.

*If the resolution selected causes the totalizer to lag behind the count rate, the next possible resolution is automatically entered.

e.g.: *Internal totalizer 1*

given: P005 = 1 (t/h)
P631 = 5

then: totalizer count increments by 10 for each 10 metric tonnes registered



External totalizer 1

given: P005 = 1 (t/h)
P638 = 5

then: contact closure occurs once for every 10 metric tonnes registered

For remote totalization, the contact closure duration (P643) is automatically calculated upon entry of the design rate (P011) and remote totalizer (P638) parameters, so that the duration of contact closure allows the relay response to track the total up to 150% of the design rate. The value can be changed to suit specific contact closure requirements, such as in the case of programmable logic controllers. If the duration selected is inappropriate, the next possible duration is automatically entered.

The totalizers are reset through the master reset (P999), the totalizer reset (P648) or through the keypad.

- master reset: the reset of all totalizer functions is included in the master reset.
- totalizer reset: totalizer reset can be used to resets internal totalizers 1 and 2, or totalizer 2 independently. Resetting the internal totalizers 1 and 2 resets the internal registers for external totalizers 1 and 2.
- keypad: pressing   while in the run mode resets internal totalizer 1

Placing the internal totalizers on to the display scroll of the run mode is controlled by the totalizer display parameter (P647); displaying either one or both totalizers.

PID Control

The PID control algorithm in the BW500 is designed specifically to work for feed rate control applications. It is based on motor control type algorithms and includes several anti-wind up provisions.

One way to prevent wind up is to monitor the input speed frequency from the weighfeeder. If the input frequency drops below 5 Hz, the PID control output freezes at its current value. Otherwise, the output winds up to 100% if the feeder is shut off while there is still a set point greater than zero. When the feeder is turned back on, there would be a surge of product flow until the system regains stability. With anti-wind up, the feeder can be stopped and started with minimal disruption to the controlled flow rate.

In order for the BW500 to operate as a controller, the following must be addressed:

- ✓ hardware
- ✓ connections
- ✓ setup and tuning
- ✓ programming

Hardware

In order for the BW500 to operate as a controller, the optional mA I/O board must be installed. Refer to Installation on page 13.

Connections

Connections to process instruments, in addition to standard operating connections, must be made.

Refer to Installation on page 13, specifically:

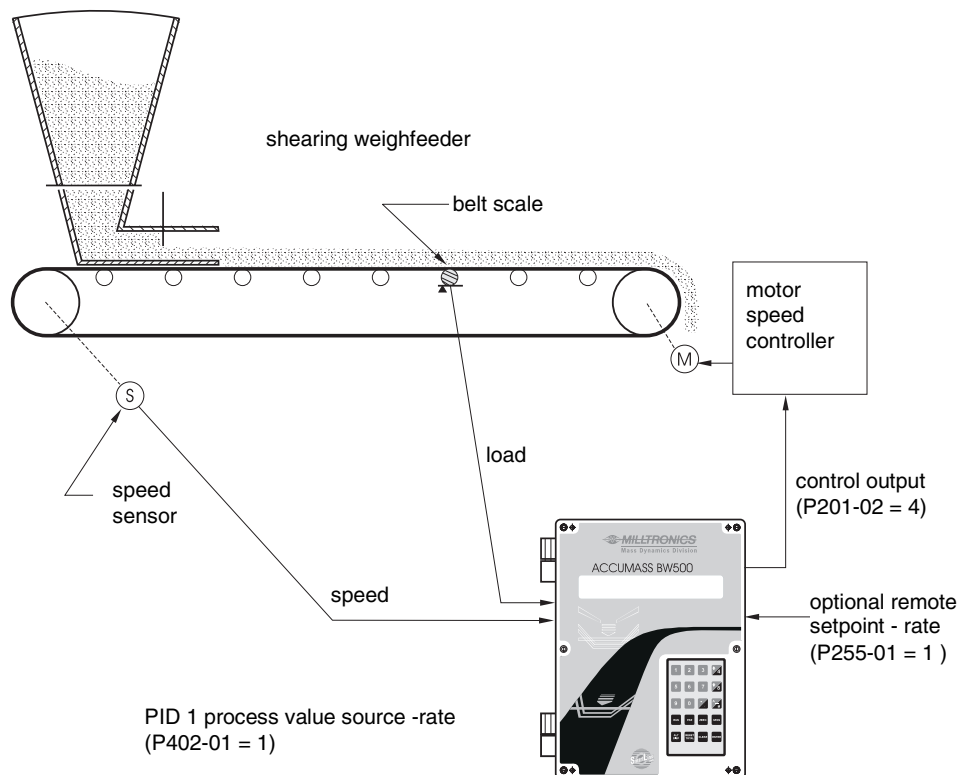
Relay Output on page 25, for relay connections
mA I/O board on page 15, for mA input and output connections
Auxiliary Inputs on page 23, for optional remote control

Connect the BW500 as either a:

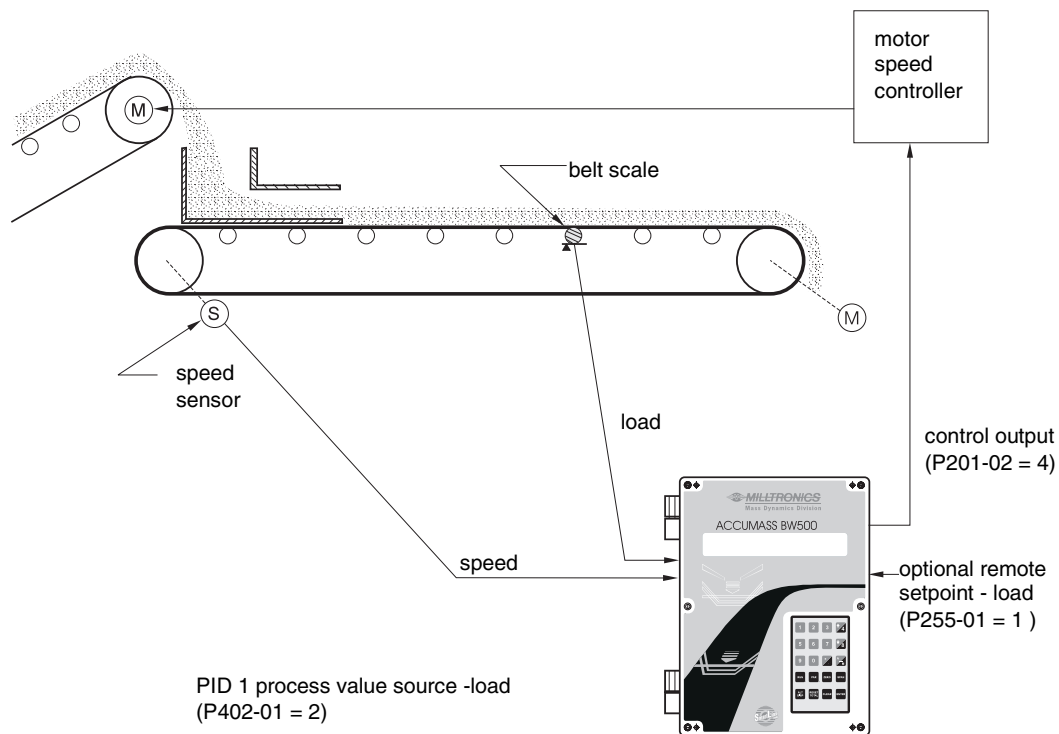
1. setpoint controller – load control
2. setpoint controller – rate control
3. setpoint controller – rate and load control
4. setpoint controller – external process variable with or without rate and load control

PID loop	mA output	terminals (mA I/O)	mA input	terminal (mA I/O)
1	2	1 & 2	1	5 & 6
2	3	3 & 4	2	7 & 8

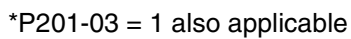
Setpoint Controller – Rate Control



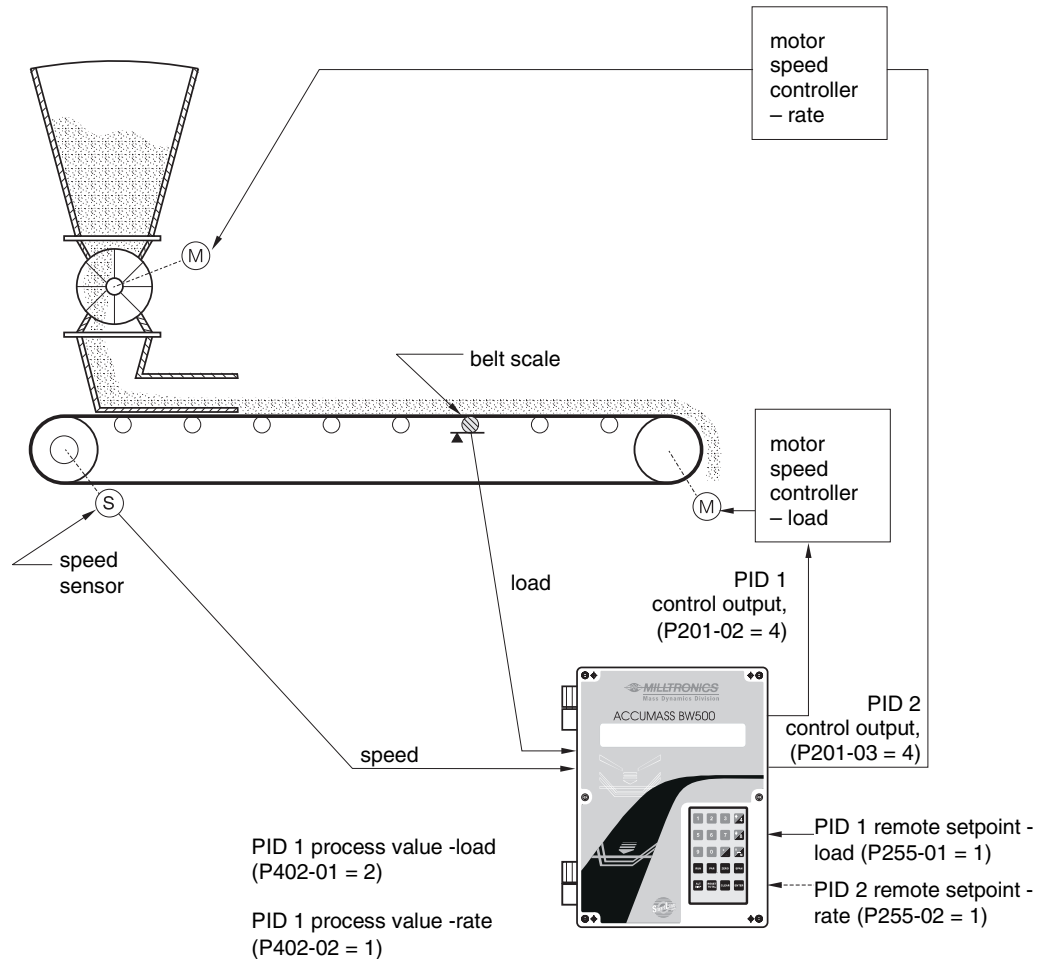
Setpoint Controller – Load Control



PID Control



Setpoint Controller – Rate and Load Control



Setup and Tuning

Before proceeding, it would be beneficial to qualify and quantify the terms you will encounter in the setup and tuning of the control system.

Proportional Control (Gain), *P*

The *P* term on the BW500 adjusts the control output based on the difference between the set point and the measured flow rate. A higher *P* term makes the BW500 more sensitive and faster to react to changes or disturbances. If set too high, the BW500 becomes less stable, and more susceptible to oscillations in the control output.

- allowable input range: 0.000 to 2.000
- typical operating range: 0.300 to 0.600
- default value: 0.400

The control output cannot reach the setpoint using only the *P* term. Since the *P* term acts on the difference between the **setpoint** and **process variable**, a small difference between these two always exist and the difference is never zero. A small *P* term can get the process very close to set point, but it would take a very long time. At the very least, an *I* term is required to eliminate the offset created by the *P* term.

Integral Control (Automatic Reset), *I*

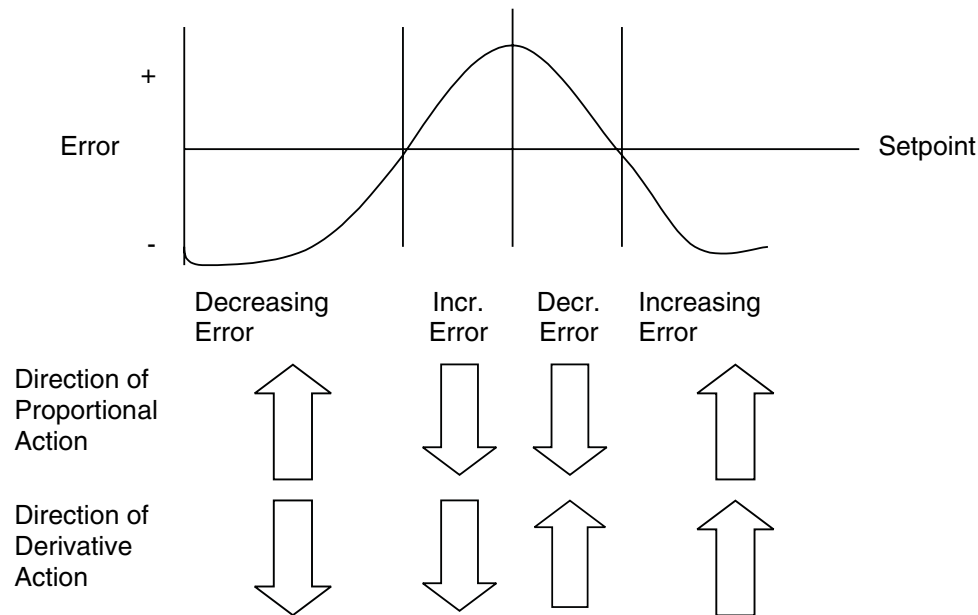
The *I* term on the BW500 is used to increase or reduce the amount of control output to eliminate the offset caused by the *P* term. The *I* term acts on the *accumulation* of the error over small increments of time. As the process reaches setpoint and the error becomes small, the effect of the *I* term decreases. A higher *I* term makes the BW500 faster to react to changes, but can also make it less stable.

- allowable input range: 0.000 to 2.000
- typical operating range: 0.100 to 0.300
- default value: 0.200

The *P* and *I* terms together can make a suitable control algorithm and for many applications, they work fine. However, if faster response to changes is desired, it is necessary to use larger *P* and *I* terms. Unfortunately, larger terms can make the system unstable. A derivative term is needed to influence the control output as the process variable approaches the set point.

Derivative Control (Pre-Act or Rate), *D*

The *D* term on the BW500 influences the control output based on changes in the magnitude and direction of the change in error. If there is a constant error, the *D* term has no effect. As the error gets larger, the *D* term combines with the *P* term to make the BW500 control output respond faster. When the error is getting smaller, the *D* term acts to reduce the amount of control output to help prevent overshooting the set point. In general, a higher *P* term will require a larger *D* term.



- allowable input range: 0.000 to 1.000
- typical operating range: 0.010 to 0.100
- default value: 0.050

The result of the derivative action is that it can make a system more responsive and more stable at the same time.

Feed Forward Control, F

On the BW500, the F term is used to adjust the control output based on a setpoint change. The use of this term can make the system reach the new setpoint faster. If the term is not used, the system responds using the P , I and D terms only. The difference between the new setpoint and the process variable is the error and the control algorithm responds to eliminate this new error.

When the F term is used and a new setpoint is entered, a proportion of the difference between the new setpoint and the process variable is automatically added on to the control output. This shifts the process variable closer to the new setpoint faster than using the P , I and D terms alone. This is done on a one time basis.

- allowable input range: 0.000 to 1.000
- typical operating range: 0.250 to 0.550
- default value: 0.300

The PID control function of the BW500 can be configured to operate in several modes.

- controller output: direct acting
- feedback: rate, load or external
- control: local or remote (ratio) setpoint

PID Setup and Tuning

Proper tuning of the control PID terms is essential to system operation and optimum performance from the feeder. The recommended procedures for tuning the PID control terms at initial start-up are described in this section.

Initial Start-Up

Although the default values of the P , I , D and F terms will suit the majority of applications, shearing weigh feeders in particular, some tuning will be necessary nonetheless.

There are several techniques and procedures for tuning conventional PID controllers, some work better depending upon the application. We recommend using "closed-loop cycling" for the BW500 integrator/controller for feed rate control. This technique focuses on tuning the P term first while disabling the I and D terms. This is followed by adding and tuning the I term, then the D term. To outline this procedure:

1. With the P term set to its default value of 0.400, disable the I , D and F terms by setting them to 0.000.
2. Enter a feed rate setpoint that is 30% of the designed maximum flow rate.
3. Having applied the test weights or chain provided, start the feeder and observe the time it takes the feeder to reach setpoint, also observe the oscillation around setpoint.
4. Adjust the P term accordingly for consistent oscillation and error. Progressively decrease the P term value if there is too much oscillation and error. Likewise,

increase the value if the error is not consistent and oscillating around the setpoint. Refer to fig 1, 2, & 3 below.

Figure 1

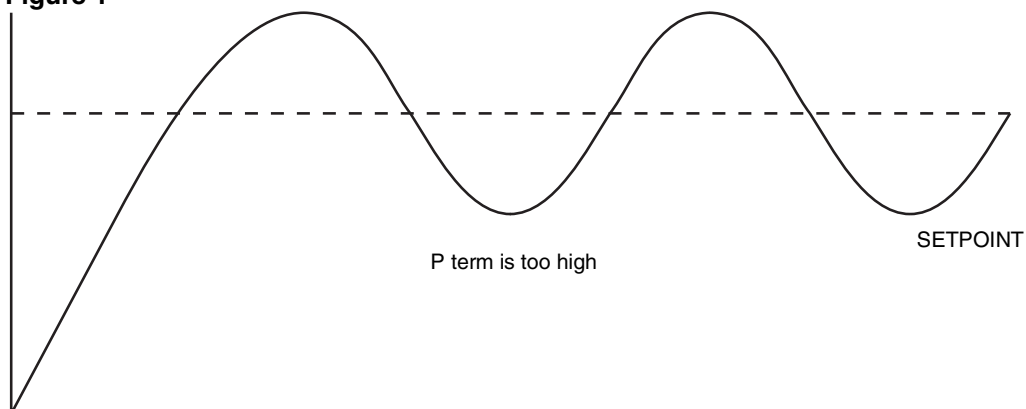


Figure 2

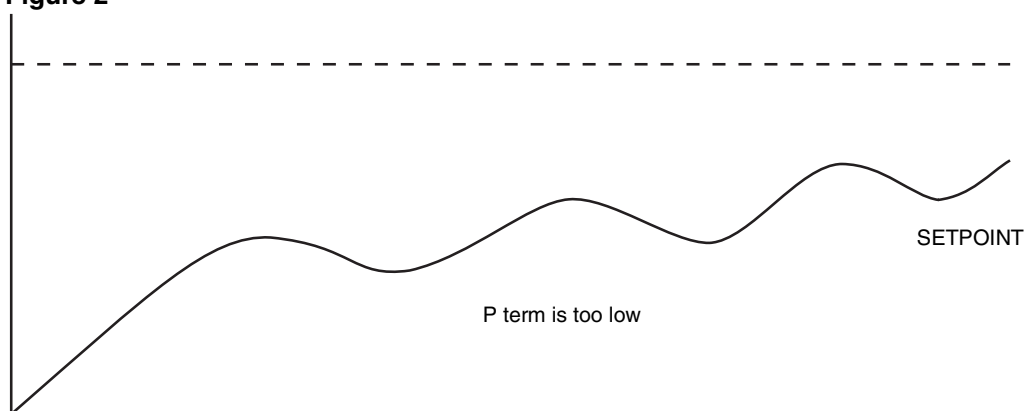
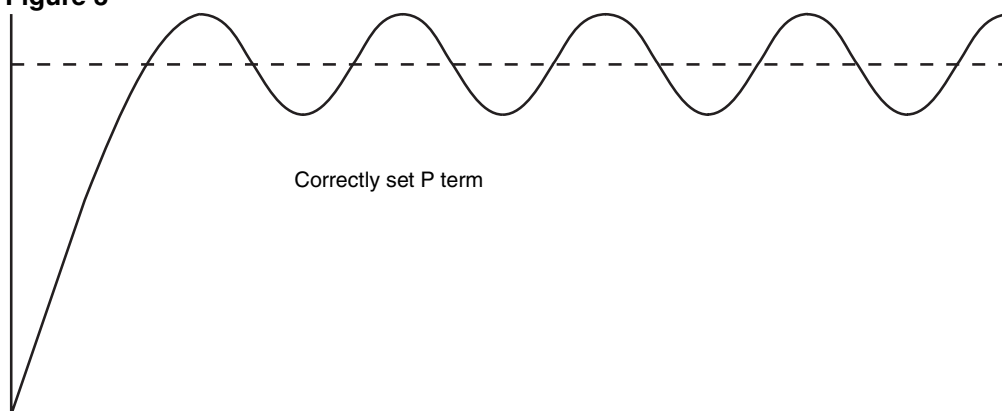
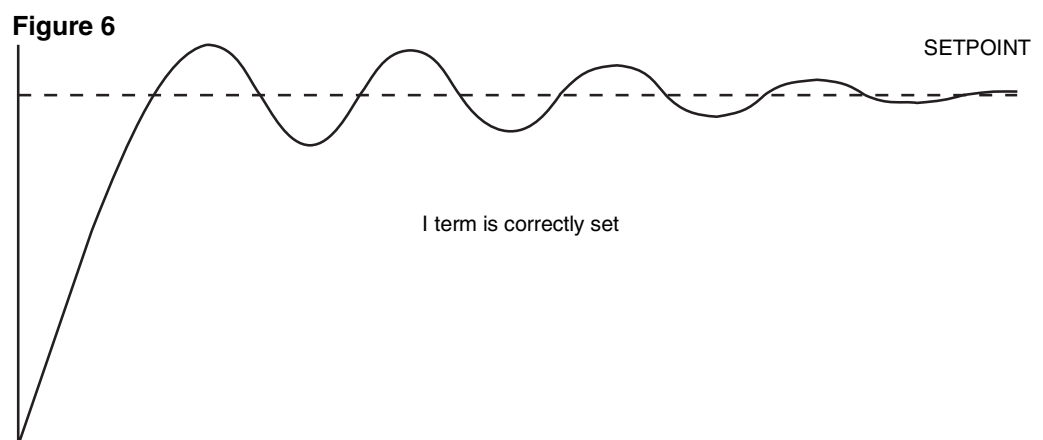
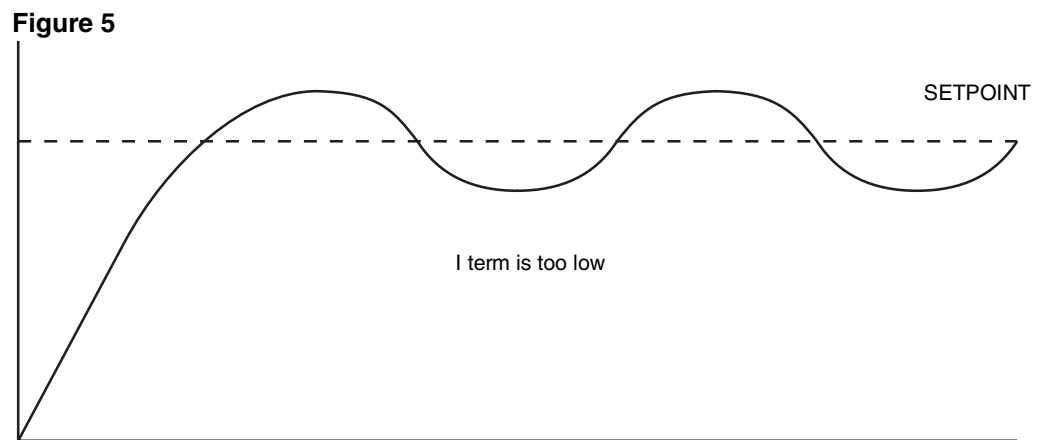
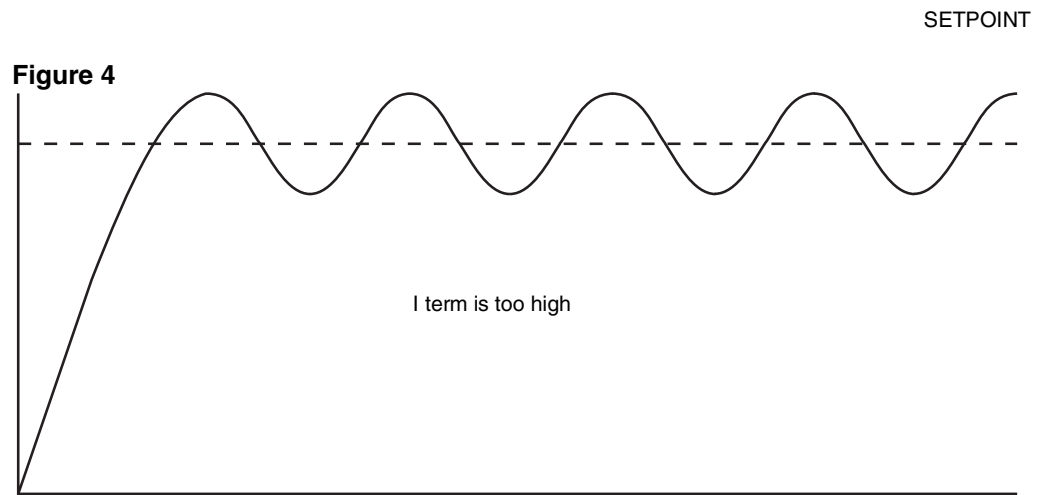


Figure 3



5. Once the P term value is set to give the control output of the BW500 consistent oscillation and the error is at its minimum, turn the feeder off.
6. The I term value can now be set. Begin by entering the default value of 0.2.
7. Restart the feeder (test weights or chains still applied) and feed rate setpoint entered.

8. Again observe the oscillation of the control output. Compare results to the figures 4,5 and 6 below.



9. The D term is not critical in typical shearing type weigh feeder applications. The purpose of the D term is to anticipate where the process is heading by looking at the time rate and direction of change of the process variable. The D term becomes very useful in applications where the material control point is far away from the measuring point. An example of this would be a weigh belt or conveyor with a belt scale

(constant speed) being fed from a pre-feeder some distance or more than a few seconds process time from the scale.

A properly set D term will make the initial oscillations around the setpoint smaller, as in figure 6. A D term set too high induces high oscillations, as in figure 4. Omission of the D term, or set too low, shows no effect on the system.

10. The above closed loop cycling procedure allows ease in start up, but final adjustments may be necessary in actual process operation.

Programming

The BW500 is software ready, however the controller function must be specifically programmed in addition to programming of parameters P001 through P017.

The BW500 offers programming for two separate PID controls, 1 and 2. The controller being programmed is identified by the suffix to the parameter number. e.g. P400-01 indicates that PID for control system 1 is accessed.

Note:


All programming should be done in the PID manual mode.

Access

P400-01 PID System	E	Select manual to program PID parameters.
Select: 0-Off, 1-Manual, 2-Auto	0	

Off disables the PID parameter set, P401 to P418. They are not accessible.

Manual: the control output is the manual output P410.

Auto: engages the PID controller function. This can also be done using the  key.

Notes:

- For the mA output:
 - mA output 2 (P201-02) is normally reserved for controller 1. The signal is output at terminals 1 and 2 on the mA I/O board.
 - mA output 3 (P201-03) is normally reserved for controller 2. The signal is output at terminals 3 and 4 on the mA I/O board.

P201-02 mA output Function	E	Select the PID function.
Select: 1- Rate, 2-Load, 3-Speed, 4-PID	1	

Note:

- For the mA input:
 - mA input 1 is an external signal normally reserved for controller 1. The signal is input at terminals 5 and 6 on the mA I/O board.
 - mA input 2 is an external signal normally reserved for controller 2. The signal is input at terminals 7 and 8 on the mA I/O board.

P250-01 mA Input Range Select: 1- 0 to 20, 2-4 to 20	E 2	Select the appropriate range for the mA input signal
P255-01 mA Input Function select 0, 1-PID SP, 2-PID PV	E 0	Assign either: 1, PID setpoint, or 2, process variable as the function of the mA input.
P401-01 PID Update Time Readings between PID Updates	E 1	Enter the value, e.g. nominal value of 1.
P402-01 Process Variable Source 1-Rate, 2-Load, 3-mA In	E	Select the source. Rate and load are internal values.
P405-01 Proportional Term Enter	E 0.40	Enter the value for the proportional term, e.g. nominal value of 0.4.
P406-01 Integral Term Enter	E 0.2	Enter the value for the integral term, e.g. nominal value of 0.2
P407-01 Derivative Term Enter	E 0.05	Enter the value for the derivative term, e.g. nominal value of 0.05.
P408-01 Feed Forward Term Enter	E 0.3	Enter the value for the feed forward term, e.g. nominal value of 0.3.
P410-01 Manual Mode Output Current Output Value	E 0	% value of output during manual operation, P400 = 1.
P414-01 Setpoint Configuration 0-Local, 1-mA In	E 0	selection of setpoint source: 0 = local (keypad or Dolphin Plus) 1 = mA input

Local: the setpoint is the value entered into P415.

mA Input 1: the setpoint is the mA value on input 1, terminals 5 and 6 on the mA I/O board.

mA Input 2: the setpoint is the mA value on input 2, terminals 7 and 8 on the mA I/O board.

<div>P415-01 Local Setpoint Value</div> <div>Enter Setpoint</div> <div>E</div> <div>0</div>	<div>Enter the setpoint value in engineering units.</div> <div>Not applicable if P414 = 1</div>
<div>P416-01 External Setpoint</div> <div>Setpoint</div> <div>E</div> <div>0</div>	<div>Current setpoint value in engineering units, obtained from the mA input</div>
<div>P418-01 Remote Setpoint Ratio</div> <div>Enter % of Master output</div> <div>V</div> <div>100.000</div>	<div>Increase or decrease to scale input setpoint, if desired.</div>
<div>P250-01 mA Input Range</div> <div>Select: 1-0 to 20, 2-4 to 20</div> <div>E</div> <div>2</div>	<div>Select the appropriate range for the mA input signal</div>
<div>P255-01 mA Input Function</div> <div>select 0, 1-PID SP, 2-PID PV</div> <div>E</div> <div>0</div>	<div>Assign either:</div> <div>1, PID setpoint, or</div> <div>2, process variable as the function of the mA input.</div>

Batching

The batching process, as it relates to the BW500 operation, can be defined as the transfer of a predetermined quantity of material.

The process supports a count up operation (P560), in that the total (totalizer 5) begins at zero and increments up to the programmed setpoint (P564). A relay (RL1 through 5) programmed as the batch setpoint function (P100 = 8) is actuated when the material total reaches the setpoint. The relay contact acts as an interlock to the material feed to end the batch.

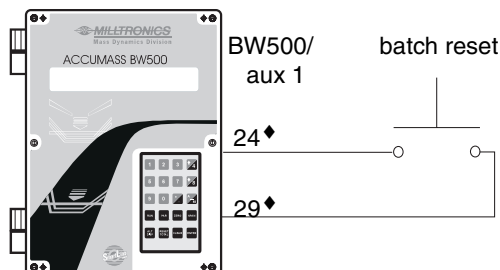
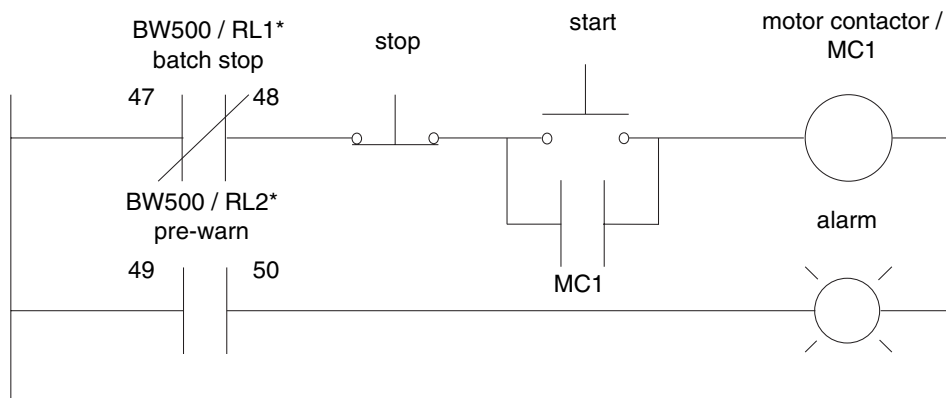
Another relay can be programmed as a pre-warn alarm (P100 = 7), to alert the process that batch end is near. The relay is actuated when the material total reaches the pre-warn setpoint (P567) at some practical value below the batch setpoint). The pre-warn function is enabled / disabled from the batch process through P566.

For batch operations, the following must be addressed.

- ✓ connections
- ✓ programming
- ✓ operation

Connections

Typical Ladder Logic



* Typical relay assignment. Relays 1 – 5 are available for batch setpoint or pre-warn alarm function.

♦ Typical auxiliary input assignment. Inputs 1 – 5 are available for batch reset.

Programming

The pre-warn function is optional.

The setpoint associated with the pre-warn relay is entered in P564, batch setpoint.

The setpoint associated with the batch relay is entered in P567, batch pre-warn setpoint.

relays: access P100, relay function
 select relay (1 – 5)
 select function 7, pre-warn

 access P100, relay function
 select relay (1 – 5, other than the pre-warn relay)
 select function 8, setpoint

batch operation: access P560, batch mode control
 select 1, enable batch operation

 access P564, batch setpoint
 enter the desired batch total

 access P566, batch pre-warn
 set to *on* (1) or leave *off* (0)

if batch pre-warn selected,
 access P567, batch pre-warn setpoint
 enter the pre-warn total

 access P568, batch pre-act,
 set to off (0), Auto (1), or Manual (2)

Operation

After connecting the BW500 relays into the process logic, and completing the prescribed programming, the BW500 is ready for totalizing the batch and stopping the process when the batch setpoint is reached. The batch operation: start, pause, resume, cancel; are controlled externally by the process control (e.g. PLC)

Place the unit in the run mode.

Press ALT DISP until the batch screen is displayed.

Rate	0.00 kg/h	SP:	20.000
Batch	0.00 kg		

e.g. relay 1 is programmed for pre-warn, P100-1=7

Start running the batch.

The display will show the rate of material flow and the batch total, as well as the batch setpoint. If pre-warn is used, relay contact is open.

When the batch total reaches the pre-warn setpoint, if programmed, the alarm event is removed and the assigned relay contact is closed.

Rate	123.4 kg/h	SP:	20.000
Batch	17.00 kg		ALM 1

The process continues, and when the batch total reaches the batch setpoint, the alarm event is displayed and the assigned relay is actuated (contact opened). Typically the relay contact would be integrated into the batch control logic to end the process.

Rate	123.4 kg/h		
Batch	20.00 kg		ALM 12

e.g. relay 2 is programmed for batch setpoint, P100-2=8

When the next batch is to be run, pressing the ENTER on the local keypad, or providing a momentary contact closure across an auxiliary input (programmed as batch reset, P270 = 8), sets the alarm display and resets the batch total to zero, and the relay contact to its closed state.

Rate	0.00 kg/h	SP:	20.000
Batch	0.00 kg		

Note:

The batch totalizer can be viewed as a read-only parameter (P649-05), using single Parameter access through any programmed communication port.

Pre-act Function

If repetitive batches are being run, the pre-act function (P568) can be enabled to automatically trip the setpoint relay before or after the batch setpoint is reached in order to assure best batch accuracy.

Certification

For installations requiring trade certification, the BW500 provides a certification compliance switch.

After certification of the installation has been obtained, the switch is set. The switch must be positioned to the left to enable trade certification compliance.

When the switch is set for certification, editing of the parameter values, span calibrations and totalizer resets are denied. Also, the maximum acceptable deviation from one zero calibration to another is limited to an accumulated $\pm 2\%$ of the initial zero.

To set the certification switch, disconnect power before opening the enclosure lid.

- slide switch to the left position
- close the lid
- reconnect the power

Certification Printing

Certification printing is allowed if the following conditions are met:

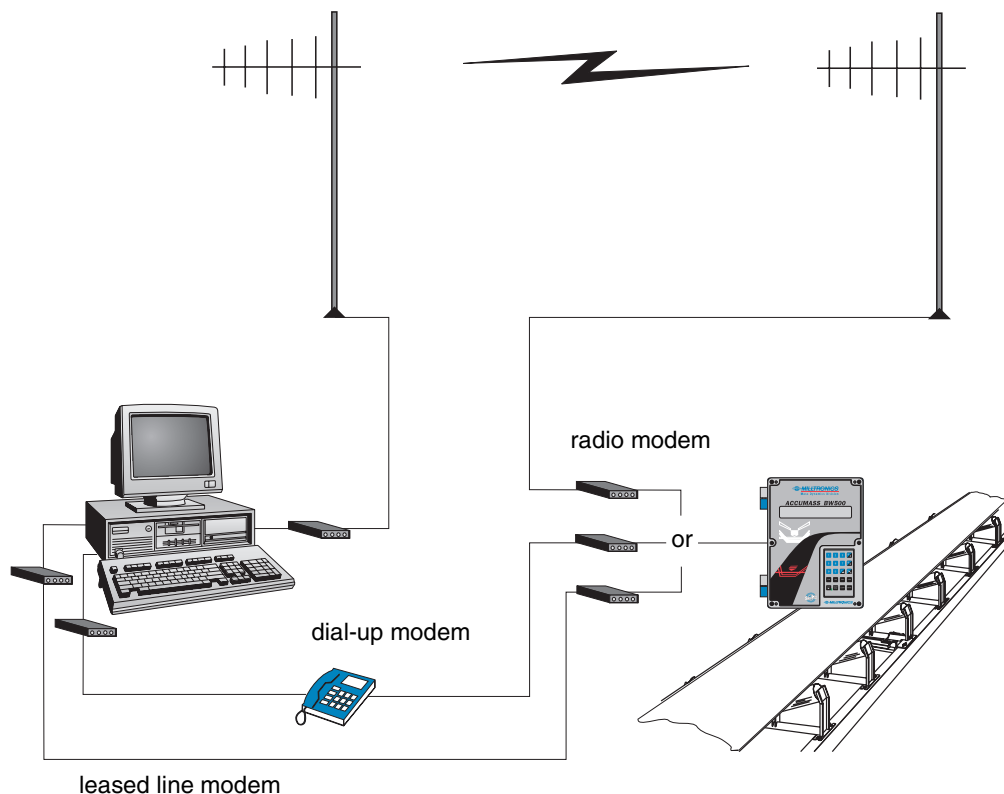
- certification switch is set
- rate is below 2 %
- a communications port has been programmed for a printer

The printout must consist of the following:

Start Total:	End total of previous print
End Total:	Accumulated totalizer including Start Total
Net Total:	End total minus Start Total

Communications

The BW500 is an sophisticated belt scale integrator that can communicate status back to a SCADA system using a serial device such as radio modems, leased lines, or dial up modems.



The BW500 supports two protocols: Dolphin and Modbus. Dolphin is a proprietary Milltronics protocol designed to be used with Dolphin Plus. Modbus is an industry standard protocol used by popular SCADA and HMI systems.

BW500 and SmartLinx®

In addition to three onboard communication ports, the BW500 is compatible with Milltronics' SmartLinx® communication modules which provide an interface to popular industrial communication systems.

This section only describes the onboard communications. For more information on SmartLinx®, please consult the appropriate SmartLinx® manual.

Warning:

When a SmartLinx® card is installed and P799 = 1, the parameters that the SmartLinx® card is writing to the BW500 will be continuously updated. Therefore, if you connect a SmartLinx® card to the BW500, set P799 = 1 and not write anything to the SmartLinx® card, your setpoints will be 0.

Connection

There are three serial communication ports on the BW500:

Port	Description
1	RS-232, terminals 31 to 34
2	RS-485, terminals 41 to 46.
3	RS-232, RJ-11 modular telephone jack

Refer to the Installation on page 13 section for wiring diagrams specific to each port.

Wiring Guidelines

Improper wiring and choice of cables are the most common sources of communication problems. Listed below are some suggested guidelines:

- 15 meters (50 feet) for RS-232
- 1200 meters (4000 feet) for RS-485
- Ensure that communication cable is run separately from power and control cables (i.e. do not tie wrap your RS-232 cable to the power cable or have them in the same conduit).
- cable is shielded and connected to ground at one end only
- 24 AWG (minimum)
- follow proper grounding guidelines for all devices on the bus
- use good quality communication grade (shielded twisted pairs) cable that is recommended for RS-232.

Configuring Communication Ports

The BW500 communications ports are setup by a series of parameters (P770 – P789) which are indexed by port.

The communication parameters are indexed to the following:

Port	Description
1	RS-232, terminals 31 to 33
2	RS-485, terminals 41 to 45
3	RS-232, RJ-11 modular telephone

f indicates the factory setting.

Note:

Changes to these parameters are not effected until the power to the unit is turned off and then back on.

P770 serial protocols

The communications protocol used between the BW500 and other devices for the selected port, ports 1 to 3 (P770-01 to -03) .

The BW500 supports Milltronics' proprietary "Dolphin" data format plus the internationally recognized Modbus standard in both ASCII and RTU formats. It also supports direct connection of a printer.

The Milltronics protocol is compatible with the Dolphin Plus configuration program. See the Milltronics web site for information on this PC product (<http://www.milltronics.com/>).

The Modbus protocol is an open standard developed by AEG Schneider Automation Inc. Specifications are available from their web site (<http://www.modicon.com/>).

Other protocols are available with optional SmartLinx[®] cards.

Values

- 0 communications disabled *f/-01 and -02*
- 1 Milltronics "Dolphin" protocol *f/-03*
- 2 Modbus ASCII slave serial protocol
- 3 Modbus RTU slave serial protocol
- 4 printer

Note:

BW500 must be in run mode to allow for the print operation.

P771 protocol address

Note:

Applicable only to ports programmed for Modbus RTU or Modbus ASCII (Parameter 770).

The unique identifier of the BW500 on the network for the selected port, ports 1 to 3 (P771-01 to -03).

For devices connected with the Milltronics protocol this parameter is ignored.

For devices connected with a serial Modbus protocol this parameter is a number from 1-247. It is up to the network administrator to ensure that all devices on the network have unique addresses.

Do not use the value "0" for Modbus communications as this is the broadcast address and is inappropriate for a slave device.

Values

0 to 9999 (*f* = 1)

P772 Baud Rate

The communication rate with the master device for the selected port, ports 1 to 3 (P772-01 to -03).

The baud rate chosen should reflect the speed of the connected hardware and protocol used.

Values

- 1 4800 baud
- 2 9600 baud
- 3 19,200 baud *f-03*
- 4 38,400 baud

P773 Parity

The serial port parity for the selected port, ports 1 to 3 (P773-01 to -03).

Ensure that the communications parameters are identical between the BW500 and all connected devices.

For example many modems default to N-8-1 which is No parity, 8 data bits, and 1 stop bit.

Values

- 0 none *f*
- 1 even
- 2 odd

P774 data bits

The number of data bits per character for the selected port, ports 1 to 3 (P774-01 to –03).

Protocol	P774 Value
Modbus RTU	8
Modbus ASCII	7 or 8
Dolphin Plus	7 or 8

Note:

If using port 2, 8 data bits must be used.

Values

5 to 8 (**f=8**)

P775 stop bits

The number of bits between the data bits for the selected port, ports 1 to 3 (P775-01 to –03).

Values

1 or 2 (**f=1**)

P778 modem attached

Sets port 1 (P778-01) to use an external modem.

Any connected modem must be set up to auto-answer incoming calls. The BW500 does not automatically configure the modem.

Autobaud (enabled by P778=1)

When the BW500 is powered up or the P779 Modem Inactivity Timeout expires three carriage returns are sent to the modem to allow it to set its serial connection to P772 Baud Rate.

If a connection is made with the modem at a different baud rate the BW500 will attempt to use that rate instead of the P772 value. For troubleshooting purposes the baud rate on the modem can be hard-coded to the rate set on the BW500. See your modem documentation for information on fixing the baud rate.

Values

0 * No modem connected
1 Modem connected

P779 modem idle time

Sets the time in seconds that the BW500 will keep the modem connected even though no activity is happening.

To use this parameter ensure that P778=1.

This parameter allows for reconnection to the BW500 unit after an unexpected disconnect. Ensure that the value is low enough to avoid unnecessary delays when an unexpected disconnect occurs but long enough to avoid timeout while you are still legitimately connected.

Hanging Up

If the line is idle and the P779 Modem Inactivity Timeout expires then the modem is directed to hang up the line. This is done with the Hayes commands:

- two second delay
- +++
- two second delay
- ATH

Ensure that P779 is set longer than the standard polling time of the connected master device.

0 disables the inactivity timer.

Values

0-9999: 0 (*f=1*)

P780 RS-232 transmission interval

Note:

Applicable only to ports programmed for printer communication (parameter 770).

Sets the interval between transmissions to be applied to the selected port, ports 1 to 3 (P780-01 to -03).

Enter the period in minutes. (*f=0*)

P781 data message

Note:

Applicable only to ports programmed for printer communication (parameter 770).

Sets the data message to be delivered via the selected port, ports 1 to 3 (P781-01 to -03).

All messages and printouts include time and date.

Entry:

0 = no message *f*

1 = rate

2 = total*

3 = load

4 = speed

5 = rate, total*, load and speed

6 = rate and total*

7 = batch total (totalizer 5)
8 = rate and speed
9 = quick start parameters (P001 – P017)
10 = all parameters

*totalizer 1 and/or 2 as set by P647, Totalizer Display

P799 Communications Control

Assigns programming control either locally through the keypad or Dolphin Plus (P770 = 1), or remotely through Modbus protocol (P770 = 2 or 3) or SmartLinx[®]

Entry:

0 = local
1 = remote

Warning:

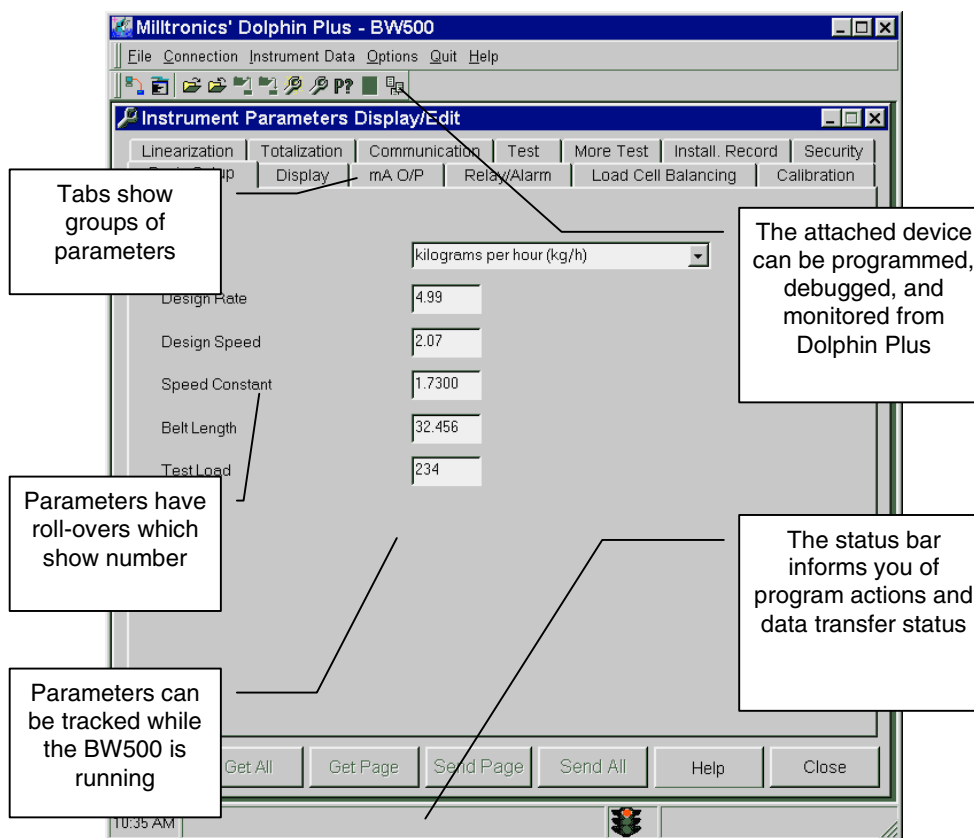
When a SmartLinx[®] card is installed and P799 = 1, the parameters that the SmartLinx[®] card is writing to the BW500 will be continuously updated. Therefore, if you connect a SmartLinx[®] card to the BW500, set P799 = 1 and not write anything to the SmartLinx[®] card, your setpoints will be 0.

Dolphin Protocol

The protocol is available on all communications ports on all units. This protocol is not available for third party use.

The primary use of this protocol is to connect the BW500 to Milltronics' Dolphin Plus configuration software.

Dolphin Plus Screen Shot



Modbus RTU/ASCII Protocol

Modbus is an industry standard protocol owned by Schneider Automation Inc.¹ and is used throughout process control industries for communication between devices. Modbus RTU and Modbus ASCII are both master-slave type protocols. BW500's Modbus is a slave unit.

BW500 supports both the RTU and ASCII version of Modbus and attempts to automatically detect the type when a connection is made.

A brief description of Modbus RTU and Modbus ASCII is given in this manual. For a full description of the Modbus protocol, contact your local Schneider representative. Also you may try their web site at:

<http://www.modicon.com>

At the time of publication of this manual, the Modbus Protocol was located under products / technical publications / communications products / Modbus protocol.

Note:

Milltronics does not own the Modbus RTU protocol. All information regarding that protocol is subject to change without notice.

How Modbus Works

As mentioned above, Modbus is a master-slave type protocol. This can also be referred to as a query-response protocol. What both of these terms mean is that on the network, there is one master which requests information from multiple slave devices. The slave devices are not permitted to talk unless they have been asked for information. When responding, the slaves will either give the information that the master has requested or give an error code consisting of why it can not give the information or that it did not understand the request. refer to Error Handling on page 135

All BW500 information is mapped into the Modbus holding registers so that Modbus function code 03 can read from them and Modbus function code 06 and 16 can write to them.

1. Modicon is a registered trademark of Groupe Schneider.

Modbus RTU vs. ASCII

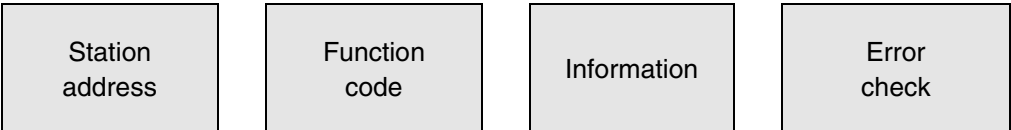
There are two main differences between Modbus RTU and Modbus ASCII. The first is that Modbus RTU encodes the message in 8-bit binary, while ASCII encodes the message in ASCII characters. Therefore, one byte of information would be encoded into 8 bits for RTU and into two ASCII characters for ASCII (which would be two 7-bit units). The second difference is that the error checking method is different (see below).

Modbus RTU has the advantage that it has a much greater data throughput than ASCII. Modbus ASCII has the advantage that it allows time intervals of up to one second to occur between characters without causing an error. Either protocol works with the BW500.

Modbus Format

Note:
When using a commercial Modbus driver all of the message details are handled for you.

To give you a better idea of how a Modbus message works, a master on network would send a message in a format similar to this:



Where:	
Station address	the network address of the slave being accessed
Function Code	number that represent a Modbus command, either: 03 read function 06, 16 write functions
Information	depends on function code
Error Check	Cyclical Redundancy Check (CRC) for RTU and Longitudinal Redundancy Check (LRC) for ASCII

There is more to the frame than is described above, this is shown to give the user a general idea of what is going on. For a full description, refer to the Modbus specifications.

Modbus Register Map

The memory map of the BW500 occupies the Modbus holding registers (R40,001 and up).

The BW500 was designed to make it easy for users to get useful information via Modbus. The following chart gives an overview of the different sections.

Register Map for BW-500

Map Legend	Description
Type:	arbitrary classification of registers.
Description:	brief description or title of associated register.
Start:	provides the starting address for the register(s) where the parameter values are to be read from or written to.
Number R:	the number of registers required to read or write the complete parameter value. Where the number of registers is greater than one, the additional register(s) are address in incrementing sequence from the start register.
Parameter Values:	refer to Parameter Values p.131
Read:	identifies the read / write capability for the register being addressed.
Reference:	provides reference documentation for the register being addressed.

Type	Description	Start	# R	Parameter Values	Read	reference
Format	Format Word for 32 bit variables	40,062	1	0-1	r/w	see p. 125
ID	Device Identifier	40,064	1	2	r	see p. 125
Handshaking Area (Parameter Access)	Parameter	40,090	1	0-999	r/w	see p. 125
	Primary Index	40,091	1	0-9	r/w	
	Secondary Index	40,092	1	0-9	r/w	
	Format Word	40,093	1	bit mapped	r/w	
	Read Value (word 1)	40,094	2	32 bits	r	
	Write Value (word 1)	40,096	2	32 bits	r/w	
Date and Time	YYYY	41,000	1	1996-2069	r/w	see P008, p. 59, and p. 127
	MM	41,001	1	1 – 12	r/w	
	DD	41,002	1	1 – 31	r/w	
	hh	41,003	1	00 – 23	r/w	see P009, p. 59 and p. 127
	mm	41,004	1	00 – 59	r/w	
	ss	41,005	1	00 – 59	r/w	
	Time Zone	41,006	1	-12 – 12	r/w	see P739, p. 83
Process Values	Rate	41,010	2	32 bits	r	see p.127
	Load	41,012	2	32 bits	r	
	Speed	41,014	2	32 bits	r	
	Total 1	41,016	2	32 bits	r	
	Total 2	41,018	2	32 bits	r	
	Device State	41,020	1	bit mapped	r	see p. 128
	Command Control	41,022	1	bit mapped	r/w	see p. 129
	Multi-Span Selection	41,024	1	1-4	r/w	see p. 50, and P365 on pg. 70
	PID 1 Setpoint	41,040	2	32 bits	r/w	see P416, pg. 75
	PID 2 Setpoint	41,042	2	32 bits	r/w	
	Batch Setpoint	41,044	2	32 bits	r/w	see P564, pg. 76
	Batch Prewarn Setpoint	41,046	2	32 bits	r/w	see P567, pg. 76
I/O	Discrete Inputs	41,070	1	bit mapped	r	see p. 129
	Relay Outputs	41,080	1	bit mapped	r	
	mA Inputs	41,090	2	0000 – 20,000	r	
	mA Outputs	41,110	3	0000 – 20,000	r	
Diagnostic	Diagnostic State	41,200	1	number code	r	see p. 138
PID Tuning	PID 1 Proportional Term	41,400	2	32 bits	r/w	see P405, p. 73
	PID 2 Proportional Term	41,402	2	32 bits	r/w	
	PID 1 Integral Term	41,404	2	32 bits	r/w	see P406, p. 74
	PID 2 Integral Term	41,406	2	32 bits	r/w	
	PID 1 Derivative Term	41,408	2	32 bits	r/w	see P407, p. 74
	PID 2 Derivative Term	41,410	2	32 bits	r/w	
	PID 1 Feed Forward Term	41,412	2	32 bits	r/w	see P408 p. 74
	PID 2 Feed Forward Term	41,414	2	32 bits	r/w	
	PID 1 Remote Setpoint Ratio	41,416	2	32 bits	r/w	see P418, p. 75
	PID 2 Remote Setpoint Ratio	41,418	2	32 bits	r/w	

Modbus Register Map (cont'd)

Format (R40,062)

This value determines the format of all unsigned, double-register integers (UINT32), *except for those in the direct parameter access.*

0 indicates that the most significant byte (MSB) is given first

1 indicates that the least significant byte (LSB) is given first

For more information on this data format see page 131

Device Identifier (R40,064)

This value identifies the Milltronics device type and is “2” for the BW500.

Handshaking Area (Parameter Access)

Built into BW500 is an advanced handshaking area that can be used to read and write 32 bit parameters.

Mapping

Parameter Read and Write (40,090 – 40,095) is a series of six registers that are used for reading and writing parameter values to and from the BW500. The first three registers are always unsigned integers representing parameters and index values. The second three registers are the format and value(s) of the parameter.

All parameters normally accessed through the hand-held programmer are available through these registers.

Address	Description
40,090	Parameter (integer)
40,091	Primary Index (integer)
40,092	Secondary Index (integer)
40,093	Format word (bit mapped)
40,094	Read value, word 1
40,095	Read value, word 2
40,096	Write value, word 1
40,097	Write value, word 2

Reading Parameters

To read parameters through Modbus follow these steps:

1. Send the parameter, its primary index, and its secondary index (usually 0) and format to registers 40,090, to 40,093.
2. Wait until you can read the above values from the registers (40,090 to 40,093).
3. Read the value from registers 40,094 and 40,095.

Writing Parameters

To set parameters through Modbus follow these steps:

1. Send the parameter, its primary index, and its secondary index (usually 0) to registers 40,090, 40,091, and 40,092.
2. Write the value to registers 40,096 and 40,097
3. Write the desired format word to register 40,093 to enable the BW500 to interpret the value correctly.

Format Register

Bits	Values	Description
1-8	0 -2	Error Code
9-11	0 - 7	decimal offset*
12	0/1	decimal shift*, Right (0) or Left (1)
13	0/1	Numeric format: Fixed (0) or Float (1)
14	0/1	Read or Write of data, Read (0), Write (1)
15	0/1	Word order: Most Significant Word first (0), Least Significant Word first (1)
16		Reserved

The bits listed above are in order from least to most significant:

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
----	----	----	----	----	----	----	---	---	---	---	---	---	---	---	---

For example, to format the level reading so that it is shown in percent with two decimal places shifted left the format bits would look like this:

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
reserved	most significant first	read	fixed format				decimal offset of +2								no error code

The value sent to the BW500 is 0001001000000000 binary or 4608 decimal. The value “4608” is sent as an integer to register 40,093 to format the output words 40,094 and 40,095 accordingly.

If the numeric data type is set for integer and the value contains decimal places they are ignored. In this situation use the decimal offset to ensure that you have an integer value and then write your code to recognize and handle the decimal offset. Bits 9 to 11 indicate the number of place by which the decimal is to be shifted. Bit 12 indicates the direction by which the decimal point is shifted, left or right. For example, if the decimal offset (value of bits 9 to 11) is '2' and the shift (value of bit 12 is '0'), then the decimal point is shifted two places to the right.

Error Codes

The error codes returned in the format area are 8-bit integers found in the lowest 8 bits of the format word. This allows for 256 potential error codes.

Currently the BW500 has two error codes available.

Values	Description
0	No error
1	Data not available as percent (available as units)
2-255	Reserved

Date and Time (R41,000 – 41,006)

The date and time can be read or written in registers 41,000 to 41,006 as defined in the table above.

Example: : If you are located in Toronto, Canada and would like to set the date and time to February 14, 1999, 1:30 p.m. and 42 seconds, you would write the following:

Register	Value
R41,000	1999
R41,001	2
R41,002	14
R41,003	13
R41,004	30
R41,005	42
R41,006	-5

Note:

The time zone register is used only as a reference, and does not affect the operation of the BW500.

Process Values (R41,010 – R41,048)

Rate, Load, Speed and Total (R41,010 – R41,019)

The associated registers provide the readings of rate, load, and speed. Totalizer 1 and Totalizer 2 in engineering units as displayed in the local BW500 display.

Device State (41,020 – 41,020)

The Device State word is used to feedback the current operating state of the product. Each bit gives the state of different parts of the product, some mutually exclusive, others are not. The state should be checked to verify any device commands.

Bit #	Description	Bit Clear (0)	Bit Set (1)
1	PID 1 Mode	Manual	Auto
2	PID 1 Freeze	No	Yes
3	PID 1 Setpoint Source	Local	Remote
4	PID 2 Mode	Manual	Auto
5	PID 2 Freeze	No	Yes
6	PID 2 Setpoint Source	Local	Remote
7	Zero	No	In progress
8	Span	No	In progress
9	-	-	-
10	-	-	-
11	-	-	-
12	-	-	-
13	Write Privileges	No	Yes
14	System Configured	Not Configured	Yes
15	Mode	Calibration Mode	Run Mode
16	Totaling	Not totalizing	Totalizing

Command Controls (41,022 – 41,022)

The command control word is used to control the unit. Each bit gives access to a command or state as if the operator was using the keypad.

Bits initiating a command (7-12) must change state in order to cause the command the begin. For example, to reset totalizer 1, Bit 9 must be set to 0, then changed to 1. It can stay set or clear for any period.

Bit #	Description	Bit Clear (0)	Bit Set (1)
1	PID 1 Mode	Manual	Auto
2	PID 1 Freeze	No	Yes
3	PID 1 Setpoint Source	Local	Remote
4	PID 2 Mode	Manual	Auto
5	PID 2 Freeze	No	Yes
6	PID 2 Setpoint Source	Local	Remote
7	Zero	No change	Start
8	Span	No change	Start
9	Reset Totalizer 1	No change	Reset
10	Reset Totalizer 2	No change	Reset
11	Reset Batch Totalizer	No change	Reset
12	Print	-	Print
13	-	-	-
14	-	-	-
15			
16	-	-	-

Warning:

Before the BW500 can be commanded remotely, parameter P799 must be set for remote control.

I/O (R41,070 – 41,116)

The BW500 provides I/O in the form of:

- discrete inputs
- relay outputs
- mA inputs*
- mA outputs*

* The standard BW500 provides only one mA output (0/4 – 20 mA). The inclusion of an optional mA I/O card provides two mA inputs (0/4 – 20 mA) and two additional mA outputs.

For the I/O, the assigned registers represent the logic status (e.g. open or closed) of the I/O as configured. Discrete inputs are configured via P270, auxiliary input function; while relay outputs are configured via P100, relay function.

The I/O are mapped into the respective input and output registers, R41,070 and R41,080, as follows:

R41,070		R41,080	
input	bit	output	bit
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5

For the mA I/O, the assigned registers represent the mA level (e.g. 0 to 20 mA) of the I/O as registered in P911 and P914, mA output test (output value) and mA input value.

The mA I/O are mapped into the respective input and output registers:

Input	Register	Output	Register
1	R41,090	1	R41,110
2	R41,091	2	R41,111
		3	R41,112

For 0 to 20 mA I/O, the register value ranges from 0 to 20,000. For 4 to 20 mA I/O, the register value ranges from 4,000 to 20,000. If the 4 or 20 mA values have been trimmed, then the register value is adjusted accordingly; e.g. an I/O value of 22 mA would be registered as 22,000.

Diagnostic (R41,200)

Refer to Troubleshooting on page 137

PID Tuning (R41,400 – 41,419)

For BW500 set up for PID control, several registers have been provided for tuning. Refer to PID Control on page 95 and the associated parameters as listed in the register map.

Note:

Before you can change any of the setpoints, P799 must be set for remote control.

Parameter Values

Bit Mapped

Bits are packed into registers in groups of 16 bits (1 word). In this manual we number the bits from 1 to 16, with bit 1 being the least significant bit and bit 16 referring to the most significant bit.

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
MSB								LSB							

32 Bit

Large numbers are put into unsigned 32 bit integers with a fixed decimal place of three. For example, a value of '7345' represents a value in the BW500 '7.345'. The default word order is that the first word is the most significant word (MSW) and the second word (register) is the least significant word (LSW).

For example, if we read R41,431 as a 32-bit, the 32 bits would look like the following:

R41,431				R41,432			
16	MSB		1	16	LSB		1
32	32-bit integer value (UINT32)						1

The whole is read as a 32-bit integer.

The most significant byte (MSB) and least significant byte (LSB) can be reversed to accommodate some Modbus drivers. See Format Word for BW-500 on page 125 for details.

Text Messages

If a Milltronics device parameter returns a text message, that message is converted to a number and provided in the register. The numbers are shown in the table below:

Number	Text Message as displayed on LCD
22222	invalid value
30000	off
30001	on
30002	≡ ≡ ≡ ≡
30003	{ } (parameter does not exist)
30004	err
30005	err1
30006	open
30007	shrt

Number	Text Message as displayed on LCD
30008	pass
30009	fail
30010	hold
30011	lo
30012	hi
30013	de
30014	en
-32768	value is less than -20,000
32767	value is greater than 20,000

Modems

The BW500 has been successfully connected to several different modems. In general, the Modbus protocol is a very modem friendly protocol. This section gives some general guidelines on modems and their connection. For detailed information, see the modem documentation.

Picking Modems

There are several different types of modems; dial-up, leased line, radio-link, fiber-optic to name the most common.

Dial-up

uses a standard analog phone line and dials the number of the receiving modem.

Lease line

come in either 2 or 4 wire types and use special phone lines that are 'leased' from your phone company (or you) and do not require any dialing.

Radio-link

come in many different types, but all use radio frequencies for transmitting the information.

Fiber-optic

uses a fiber-optic line to connect the two modems.

Each type of modem and each model have various characteristics. Before purchasing the modem contact the modem manufacturer and ask if they have had experience using the modems with Modbus protocol with no flow control. If they have, ask them what settings were required.

Setting up the Modems

Modems can be configured using software, dip switches, jumpers or a combination.

Dip switches are normally located at the back of the modem, jumpers are normally located on the motherboard and require that you remove the cover. Software normally requires you to use a standard terminal program and to connect to the RS-232 port on the modem and send special commands. The most popular command set is called the AT, or Hayse, command set.

Your modem manual should give details on how to configure it.

Example Setup

For a typical dial-up modem, try the following setup as a first attempt:

Master

Modem

- auto answer off (dip switch?)
- load factory default (dip switch?)
- no flow control (dip switch?)
- baud rate = 9600
- 10 data bits (probably the default)

Modbus RTU Software

- baud rate = 9600
- 8 bit
- no parity
- 1 stop bit
- dial prefix: ATDT
- Initialization command: ATE0Q0V1X05=0512=100
- Reset command: ATZ
- Hang-up command: ATHO
- Command response delay: 5 seconds
- Answer Delay: 30 seconds
- Inter-character delay: 55 ms

Slave

Modem

- auto answer on (dip switch?)
- load factory default (dip switch?)
- no flow control (dip switch?)
- baud rate = 9600
- 10 data bits (probably the default)

BW500

- set P770, port 1, to the value 3 (Modbus RTU)
- set P771, port 1, to the value 1 (Network ID 1)
- set P772, port 1, to the value 3 (Baud rate of 9600)
- set P773, port 1, to the value 0 (No Parity)
- set P774, port 1, to the value 8 (8 Data Bits)
- set P775, port 1, to the value 1 (1 Stop Bit)
- set P778, port 1, to the value 1 (Communications through Modem)
- set P779, port 1, to the value 300 (Modem Inactivity of 300 seconds)

Note:

The meaning of these parameters are outlined in the Installation section

Error Handling

Modbus Responses

When polled by a Modbus Master, a slave device will do one of the following:

1. **Not reply.**
Which would mean that something went wrong with the transmission of the message.
2. **Echo back the command with the correct response.**
This is the normal response. (see the Modbus specifications for more details).
3. **Return an Exception Code.**
This would reflect an error in the message.

BW500 uses the following exception codes:

Code	Name	Meaning
01	Illegal Function	The function code received in the query is not an allowable action for the slave.
02	Illegal Data Address	The data address received in the query is not allowable address for the slave.
03	Illegal Data Value	A value contained in the query data field is not an allowable value for the slave
04	Slave Device Failure	An unrecoverable error occurred while the slave was attempting to perform the requested action.
05	Acknowledge	The slave has accepted a request and is processing it, but a long duration of time is required.
06	Slave Device Busy	The slave is processing a long-duration program command
08	Memory Parity Error	The slave attempted to read extended memory, but detected a parity error in the memory. Service may be required on the slave

Error Handling

Errors can be divided up into two general sources. Either:

1. There is an error in transmission
2. The user tries to do something that is not a valid action

In the first case, the BW500 will, not respond and let the master wait for a 'response time out' error, which will cause the master to re-send the message.

In the second case, it depends on what the user tries to do. Listed below are various actions and what the expected outcome is. In general, BW500 will not give an error to the user request.

- If the user reads an invalid parameter, the user will get a number back.
- If the user writes an invalid parameter (a non-existing parameter or a read only parameter), the value will be ignored and no error response will be made. However, the current value will not reflect the desired new value.
- If the user writes a read only register, then the value will be ignored and no error response will be made. However, the current value will not reflect the desired new value.
- If the user attempts to write one or more registers that are out of range, an exception response code 2 will be generated.
- If using an unsupported function code, undocumented results may occur. The user is encouraged not to do this.

Troubleshooting

Generally

1. First check to see that:
 - a. There is power at the unit
 - b. The LCD is showing something
 - c. The device can be programmed using the fixed keypad.
2. Then, check the wiring pin outs and verify that the connection is correct.
3. Next, go over the setup parameter P770 to P779 and verify that these values match the settings in the computer that you are using to communicate with it.
4. Finally, if you should check that the port you are using on the computer. Sometimes trying a different Modbus driver will solve the problem. An easy stand-alone driver called ModScan32, is available from Win-Tech at www.win-tech.com. We have found that this driver has been very useful to test communications.

Specifically

Q1: I tried to set a Milltronics device parameter, but the parameter remains unchanged.

- A1.1:**
- a. Try setting the parameter from the keypad. If it can't be set using the keypad, check the lock parameter (P000) and,
 - b. Check to ensure that the SW1 (certification switch) is not in the certification position.

Error Codes

Error Code	Code Name	Message/Action
200	No Speed	No speed registered during calibration. Check conveyor running or speed signal.
201	Error – Load Cell A & B	Reading between A & B > 20000, or no signal. Check wiring.
202	Error – Load Cell C & D	Reading between C & D > 20000, or no signal. Check wiring.
203	Err: 203	Memory failure test. Consult Milltronics.
204	Integrator not configured	P002-P017 must be programmed
205	Err: 205	Zero or span calibration required.
210	Remote Totalizer 1 exceeded	Increase resolution.
211	Remote Totalizer 2 exceeded	Increase resolution.
212	Maximum speed exceeded	Speed is > twice the design speed. Check design belt speed, actual belt speed, speed constant. Perform speed constant adjust (P018) if necessary.
213	Maximum rate exceeded	Rate is > thrice the design rate. If no mechanical cause, check to see if re-rating the design rate is required.
220	Span Too Low	Span is < 1 mV. Insure proper test weight or chain is applied during span.
221	Span out of range	Span deviation > 12.5%. Consider an initial zero (P377). Refer to Initial Zero on page 46.
222	Zero out of range	Zero deviation > minimum limit. Consider an initial Span (P388). Refer to Initial Span on page 49.
223	Security Violation	An attempt to run command / calibration that is not allowed under current security level.
224	Function not permitted	Function not allowed under current security level.
225	BF	Flashes in the bottom right corner of display when battery charge is too low.
226	Load Cell AD's are not functioning	Consult Milltronics.
227	Err: 227	No process data available. Consult Milltronics.
228	Batch pre-act adjustment > 10%	Pre-act adjustment is ignored. Tune process to limit batch error.
240	Integrator not configured	P002-P017 must be programmed
241	No PID mA Input	PID Process Value Source (P402) or PID Setpoint (P414) has been programmed for a mA Input, however mA Input Function (P255) has not been programmed properly.
242	No PID mA Output	PID System (P400) has been turned on, but mA Output (P201) has not been programmed properly.
243	No batch setpoint relay	Batch has been setup, but no relay has been configured for a setpoint.

Appendices

Memory Backup

The BW500 requires no maintenance or cleaning, other than a periodic replacement of the memory backup battery. Refer to Installing/Replacing the Memory Back-up Battery on page 27.

Software Updates

The software can be updated from a floppy disk by use of a PC (IBM Compatible) with Milltronics Dolphin Plus software.

It is recommended that the old software and parameters be saved to your PC before downloading the new software.

Once installed, a master reset (P999) must be done.

The parameters can then be reloaded, either manually or downloaded from the previously saved file. If downloading parameters via Dolphin+, confirm that BW500 is in Program mode. The zero and span values are included in the parameter file. However, new zero and span calibrations should be done regardless, and as soon as possible to insure operating accuracy.

Calibration Criteria

Zero:

- belt must be empty
Run the conveyor for several minutes to limber the belt and ensure that it is empty.
- test weights or chain are not used during a zero calibration.
- conveyor running at normal speed

Span:

- a zero must be done prior
- belt must be empty
- test weight or chain must be applied.
- conveyor running at normal speed test reference (chain or weight applied)

PID Systems:

- zero and span criteria must be met
- set controller (P400) to manual and adjust the output for 100% belt speed (using the 4 and 8 keys).
If the PID is not set to manual, the speed output will be the last value prior to starting the zero or span calibration
- shut off the prefeed to conveyor
In process where a prefeed device is included, it must be turned off to ensure that no material is fed onto the belt.

MILLTRONICS

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Printed in Canada