OPERATION & MAINTENANCE
FOR
ULTRON+ CONTROLLER
WEIGH FEEDER/SOLID FLOW FEEDER

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1.0 Technical Information

1.1 Power Supply

Voltage	24vdc
Power Consumption	<3w

1.2 Display

Display Type	OLED
Display Resolution	64*128
Display Color	Yellow

1.3 Environment Conditions

Operating Temperature	0 ° C to +50 ° C
Storage Temperature	-20 ° C to +50 ° C

1.4 Measurement Input Loadcell

Supply Voltage	Internal 5 V ± 5 %
Measuring cable	6/4 wire Technique
Measurement Input Range	0 to 20mv

1.5 Measurement Input Tacho

Supply Voltage	Internal 12V ± 5 %
Measuring cable	3 core shielded
Measurement Input Range	10 - 2000 Hz, 12 V

1.6 Digital Input

Number of Inputs	14(MB 2 ,DIOCard_1 4,DIOCard_2 4,AIDICOM 4)
Input Type	Opto-Coupled
Function	Assign to any function using inbuilt PLC Program

1.7 Digital Output

Number of Outputs	16(MB 4 ,DIOCard_1 4,DIOCard_2 4,AIDICOM 4)
Output Type	Transistor output
Function	Assign to any function using PLC Program

1.8 Analog Input

Number of Inputs	3(AOCard_1 1,AOCard_2 1,AIDICOM 1)
Input Type	0-20mA,4-20mA,0-10Vdc optically isolated
Function	External Set point

1.9 **Analog Output**

Number of Outputs	3 (AOCard_1 1,AOCard_2 1, AIDICOM 1)
Output Type	0-20mA,4-20mA,0-10Vdc optically isolated
Function	Corresponding to any of the following functions -Actual federate -Belt Speed -Belt Load -Weigh feeder/solid flow feeder Drive Set point -Pre- Feeder Drive Set point

1.10**USB Interface (X2)**

Connector	USB Type A
Function	Upload/Download parameters to/from Controller to PC/Laptop

1.11**RS485 Interface (X4)**

Connector	2pin
Transmission	Half duplex, serial bit, asynchronous mode
Baud rate	19200
Function	Used to interface Inverters

1.12**RS485 Interface (X5)**

Connector	2pin
Transmission	Half duplex, serial bit, asynchronous mode
Baud rate	19200,38400,57600
Function	Modbus RTU Slave for PLC/DCS interface

1.13**Profibus-DP Slave Interface (X5)**

Connector	9pin, DB
Transmission	RS485
Baud rate	9600 to 12Mbps max
Function	Profibus-DP Slave for PLC/DCS interface

1.14**Modbus-TCP Slave Interface (X5)**

Connector	RJ45
Transmission	Ethernet
Baud rate	10/100 mbps
Function	Modbus-TCP for PLC/DCS interface

2.0 Functional Description

2.1 Principle

The Weigh feeder/solid flow feeder consists of a conveyor belt whose material load is continuously weighed with a measuring device. The mass flow is calculated from the product of Belt Load (Loadcell value) and belt speed (Tacho frequency).

The amount of material being conveyed is controlled by controlling the belt speed. This is done by generating the Setpoint and control signals to control a suitable drive controller. Belt speed is monitored to ensure that the required speed is being achieved by the drive controller.
In addition to controlling the material flow rate, the system can also control a Pre-feeder to control the material bed-height

2.1.1 Weigh feeder/solid flow feeder System, Overview:

The unit is operated using the keypad and the OLED display. The display values are called using fixed keys or displayed through pull-down selection.

The Configuration of the system is determined by the parameter values. To do this, a selection is made from the fixed values in the configuration menus or a parameter is entered using the front keypad.

2.1.2 System Features

- Fail safe EEPROM memory for configuration parameters
- Date/Time in battery buffered Real Time Clock
- Integrated keyboard and display
- Up to 14 inputs /16 outputs
- 2 Pulse outputs
- Analog to Digital and Digital to Analog signal interfaces
- Zero correction
- Inbuilt PLC for easy adaptation to different control schemes
- Auto Calibration

2.2 Functions

2.2.1 Modes of operation

The system can operate in any one of the following modes,

i) **Interlock - Gravimetric Mode**

In this mode, the system operates through External setpoint in the form of analog 4-20 mA signal or Communication Set point through the serial interface.
Start/Stop to the system is either through external digital Inputs or through the serial Interface.

ii) **De-Interlock - Gravimetric mode.**

In this mode, the system operates through Setpoint entered through the keypad.
System Start/Stop is through the keys provided on the keypad.

iii) **Manual - Volumetric mode.**

In this mode, the system operation is un-regulated (Volumetric). Setpoint and Start/Stop is from the keypad.

iv) **Local Mode**

In this mode, Setpoint& Start/Stop commands to the system are from the Local Control station.
In this mode, system operation is un-regulated (Volumetric) i.e. the Setpoint from the Local control station directly varies the belt speed.

2.2.2 Belt off-track monitoring

Off-track running of the belt can be monitored via an external signal from the Belt tracking sensors to the control unit

2.2.3 Zeroing

Belt related influences on the belt load can be compensated by means of zero correction. To do this, the correction process is started with the belt running idle. The zero correction value, with which the belt load is set off, is calculated automatically after the zero correction process. The zero correction is initiated from the front keypad.

2.2.4 **Auto Calibration**

If a hopper with a measuring device is present on the weigh feeder/solid flow feeder, it is possible to perform Auto calibration. In this case, the material volume removed from the hopper within a defined period of time is compared with the volume of material which the weigh feeder has recorded for the corresponding period. In the event of a difference, a correction value is calculated, which is taken into account when measuring the belt loading. Thus, it is possible to compensate zero point fluctuations, which may have occurred during operation.

2.2.5 **Error Messages**

Faults/Errors caused by incorrect operations are displayed in clear text in the control display.

2.2.6 **Scale Types**

2.2.6.1 Directly extracting weigh feeder/solid flow feeder

Material is extracted directly from hopper, without pre-feeding device

2.2.6.2 Weigh feeder/solid flow feeder with pre-feeder regulation

As a result of variation of belt speed, required for output regulation, a varying bed-height of material may occur on the conveyor belt. If a constant bed-height of material is required or in the event of unfavorable material properties which do not permit direct extraction, pre-feed regulation is necessary

2.3 **Interfaces**

2.3.1 **PLC Interface**

It is possible to enable remote monitoring and control of the system, by connecting the unit to a master controller (PLC/DCS) through the RS-485 serial interface. Modbus RTU protocol is supported for this communication.

2.3.2 **Pulse Output**

Two pulse outputs are available from the system corresponding to the quantity being conveyed. The pulse width of the Totaliser pulses is configurable in Configuration menu.

2.3.3 **Analog outputs**

Analog outputs are available for display and/or measurement tasks. Up to 2 analog current outputs can be generated from the system. Each individual output can be selected to various measurement/control variables, such as Feeder Setpoint, Material Feed rate, Belt loading, Belt Speed.

2.3.4 **Digital I/O**

6 inputs and 8 outputs are available for controlling the weigh feeder/solid flow feeder and other plant interlocks. Outputs are available corresponding to various status and fault conditions in the system. Additional 4 Input / 4 Output or 8 Input / 8 Output Cards can be connected to the Controller for additional Digital I/O.

2.3.5 **Modbus Interface**

The controller can be directly connected to PLC through this MODBUS interface. It is possible to enable remote monitoring and control through this interface.

3.0 Operators Instructions

3.1 **Keypad and display**

3.1.1 **Keypad**

Definition of keys change as per the menu operations . Some keys have alphabets. These are used in editing the PLC programs. The numbers 0 to 9 keys are used for numeric entries.

Characters/Symbols used in the keys have following meaning,

	Display Current Setpoint
	BL: Display Belt Load in %
	Display Totaliser 1
	Display Actual Feed rate
	Display Tacho Frequency
	Display Totaliser 2
	Start Zeroing in Manual mode Start Auto calibration in auto mode
	Switch between Interlock / De-interlock modes
	Switch between Volumetric / Gravimetric modes

	Start/Stop System
	- Selection of options from list.
	-Scroll Menu / parameter list being displayed.
	-Scroll Menu / parameter list being displayed.
	- Used to exit and save from online / Offline menu. - Used in combination with 'CL' to exit from PLC Editor - Used to accept values modified in the online / Offline menu.
	-In Online screen,T1 value displayed in Line 5th line is cleared - Used to Clear Error displays
	-Call Online / Offline menus within Online Screen
	-Accept auto calibration value if within range

3.1.2 Display

When the Controller is powered on from the mains, the display "AAG Ultron+ "along with Software version will appear for 3 secs. The system enters the Online Screen at the end of 3 sec. delay.

a) In the Online Screen, the following parameters can be displayed by selecting keys from the keypad, 'Setpoint', 'Belt Load', 'Feed Rate', 'Total1',Total2','Belt Speed':

Cur_Sp	Current Setpoint in units selected
Load	Belt load value in %
TPH	Actual Feedrate value in units selected
S1	Totaliser1 value
S2	Totaliser2 value
Tacho	Weigh feeder/solid flow feeder Tacho frequency in Hz.

Other Values are selectable with the **'↑'** & '↓**'** key. These values are shown below with their designated names.

Int_Sp	De-Interlocked Setpoint
Ext_Sp	Interlocked Setpoint
Com_Sp	Interlocked Setpoint through SIO
Man_Sp	Manual mode Setpoint
Dev	Deviation in %
WF_SP	Weigh feeder/solid flow feeder drive Setpoint in %
PF_SP	Pre-Feeder drive Setpoint in %
Hopper	Hopper load value in units of S1
Postn	Gate Position
HOP_Totl	Hopper Level reduction during Control Measurement
FDR_Totl	Feeder Totaliser during Control Measurement
CM_Diff	Difference between HOP_Total & FDR_Total
CM_%	Control Measurement Error in %

b) <u>Error messages</u>

The error messages have the highest priority, i.e. they are not overwritten by any other display and remain in display until they are acknowledged.

The error messages are listed in section 5.0 "Errors Messages" of this manual.

3.2 **Functions**

3.2.1 **Start**

Mode	Start Trigger
De-Interlock-Gravimetric	'Start' from Keypad
Manual	'Start' from Keypad
Interlock-Gravimetric	'Start' from external digital input
Interlock-Gravimetric	'Start' from Serial
Local	Local pushbutton

Display - LED 'START/STOP' on. And, "START" is displayed on Upper Left Corner of Display

3.2.2 **Stop**

Stop trigger for all modes

Mode	Start Trigger
De-Interlock-Gravimetric	'Stop' from Keypad
Manual	'Stop' from Keypad
Interlock-Gravimetric	'Stop' from external digital input
Interlock-Gravimetric	'Stop' from Serial
Local	Local pushbutton

An Error condition can also cause the Feeder to stop

3.2.3 **Zeroing**

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Zeroing is initiated by pressing 'Zeroing' key.

Conditions

- System in Manual mode
- Belt started

Display - LED over 'Zeroing key' flashing.

Note:

Zero setting operation can be canceled by pressing 'Zeroing' key during zeroing process. With canceling, the old zero setting value is not lost.

Operation:

The zeroing runs for one belt revolution determined by the belt revolution time set in configuration. After zero setting operation, the mean value over the zero curve is calculated and the belt load is re-calculated with the zero correction value. An error message occurs when the correction limit is exceeded.

3.2.4 **Interlock/De-Interlock**

Press ‘Manual’ key then use ‘AUTO’ key to switch between Interlock and De-Interlock mode.

Display:
Interlock: LED over 'AUTO.' ON & LED over 'Manual.' ON
De-Interlock: LED over 'AUTO.' OFF & LED over 'Manual.' ON

Note:
Switching between the modes is only possible in Weigh feeder/solid flow feeder Stop mode.

3.2.5 **Auto Calibration**

Auto Calibration is initiated by pressing ‘Zeroing’ key.

Conditions
- System Started in automatic mode.
- Feeder configured with pre-hopper scale i.e. Pre-Hopper=Yes

Display - LED over 'Zeroing key’ flashing.

Note:
The Auto calibration is aborted if,
- The hopper weight falls below the pre-hopper Limit1
- The hopper is being filled.
- An abort request is received from the keypad or super-ordinate system.
- System is switched to manual operation.

Operation:
Initiate Auto calibration via front keyboard or external input. Automatic filling of pre-hopper to pre-hopper Limit3 if the hopper weight is lower than Limit2 at the time of starting the Auto calibration. Wait for the damping period.
Auto calibration is started for time defined by Parameters "Rev Time" * "No Rev". Values, "FDR_Totl"-Material conveyed by feeder and "HOP Totl"-Material extracted from hopper are calculate
On completion of Auto calibration, the following values are calculated ,”CM_Diff” difference between” FDR Totl ” & “HOP Totl “. CM diff is displayed in terms of percentage using “CM%”
The error value can be corrected via front keyboard (' 'key), external input.
The correction is applied to Feeder Tare.
The correction for Auto calibration error is limited by the maximum correction limit parameter ”Zero Limit” entered in controller.

3.2.6 **Error Acknowledgment**

'CLEAR' key is used to acknowledge errors.
Display
The Error text message is displayed in line 6. Led 'START/STOP' Flashing.
Note:
If an error is already in the display, further errors will not be displayed until this error has been acknowledged.

3.3 **Modes**

Current Operating Mode of machine is displaying at upper right corner of online screen

3.3.1 **Local mode**

This mode is invoked by a "Low" signal on the 'Local/Remote' digital input. In this mode, Setpoint& Start/Stop commands to the system are from the Local Control Station. System operation in this mode is unregulated. In this mode, "Manual" led keeps blinking

3.3.2 **Remote mode**

This mode is invoked by a "High" signal on the 'Local/Remote' digital input. This mode is further sub-divided into the following modes.

3.3.2.1 **Interlock - Gravimetric mode**

This mode is invoked by a "Low" signal on the 'Int/De-Int' digital input. Select' digital input or selected through Serial . Selection either from External Inputs or from Serial Interface is defined in the Configuration Menu. In this mode, Setpoint is form 4-20mA or via Serial, Start/Stop are through external I/Os(Auto & Manual Led ON) or via Serial interface(Auto Led blinking).

3.3.2.2 **De-Interlock - Gravimetric mode**

This mode is invoked by a "High" signal on the 'Int/De-Int' digital input . Select' digital input or selected through keypad. Selection either from External Input or from Keypad is defined in the Configuration Menu. In this mode, Start/Stop &Setpoint are through the keypad(Manual Led ON Auto Led Off).

3.3.2.3 **De-Interlock** - Volumetric (Manual) mode

System operation in this mode is un-regulated.
In this mode, Start/Stop & Setpoint are through the keypad.(Auto & Manual Led OFF)

Zero setting operation is possible in this mode.

3.4 Parameter Input

3.4.1 Performance Parameters

In this menu, parameters related to the PI regulator are set. Explained in menu operations

3.4.2 Setpoint

In this menu, it is possible to input the set points for system operation. The set points are entered with the units and decimal points as selected in configuration.

Operating mode	Valid Setpoint
De-Interlock - Volumetric	Man_Sp
De-Interlock - Gravimetric	Int_Sp

3.5 Error Messages

Error Messages occurring during operation are shown below.

"Message"	=	Meaning
	>	Help
"Tacho Fault"	=	Tacho freq. input missing
	>	Check tacho, tacho cable
"Drive Fault"	=	external drive disturbance
	>	check drive interlocks
"Belt Track Fault"	=	Belt off track message at input for time greater than permissible time
	>	Set belt
"Deviation Fault"	=	Actual capacity outside the tolerance band longer than =deviation time=
	>	check load, setup
"Interlock Fault"	=	Downstream Interlock input not present
	>	Check input.
" Overload Alarm"	=	BL> MAX. LOAD value set in Measuring Parameter.
	>	Check material on belt
"Underload Alarm"	=	BL< MIN. LOAD value set in Measuring Parameter.
	>	Check material on belt
"Emergency Stop"	=	Emergency stop switch pressed
	>	Check Switch status, cable.

"Zero corr > set_Lmt"	=	Zero correction error greater than permitted
	>	Check belt load, repeat zero correction
"CORR. ABORTED"	.=	Zero correction cycle aborted.
	>	Check Tacho input, Drive Interlock input.
"ACAL Abort"	.=	Auto calibration cycle aborted.
	>	Check Pre hopper on input, or any fault occurred during operation.
"ACAL > Limit"	=	Auto calibration correction error greater than permitted
	>	Check belt load ,repeat auto calibration
"AI Calib Error"	=	This error occurs during AIO scaling if Max_Value selected is lower than Min_Value or Communication error with Analog input module
	>	Check analog input value, Interface
"Modbus Com Error"	=	Communication error with Modbus Module
	>	Check connection, interface, setup
"Loadcell1 Fault"	=	Loadcell1 not Connected
	>	Check Loadcell Connections
"Loadcell2 Fault"	=	Loadcell2 not Connected
	>	Check Loadcell Connections
"ZSS Fault"	=	Zero Speed Switch input missing for time greater than permissible time
		Check Belt

4.0 COMMISSIONING INSTRUCTIONS

4.1 First start

When starting for the first time the following procedure must be followed:
Steps

- Check jumpers
- Connect peripheral appliances
- Enter parameters by pressing SELECT key for 3 sec on power on
- Enter PLC Program
- Calibrate system
- Zero setting
- Ensure that all parameters entered correctly.

4.2 Parameters

See "Menu Operations" (section 2.0) for description about menu parameters and operations.

4.2.1 System Par (System Parameters)

=Units, Capacity= Units, Capacity
Designation of all capacity displays.
If "t/h" is selected as designation, all other values are automatically defined with "t".
Select: kg/h, t/h

=Dec pt, Capacity= Decimal point, capacity
Definition of the position of the decimal point within the 4 digit capacity display.
Select:0000 / 000.0 / 00.00 / 0.000

=Capacity= Nominal capacity
Flow rate with 100% belt load and nominal tacho frequency = 100% capacity.
Input: Numerical value of capacity

=Dec Pt, Total1=Decimal point, Totaliser 1
Definition of the position of the decimal point within the 6 digits display of
Totaliser 1
Select: 000000 / 00000.0 / 0000.00 / 000.000

=Units, Total1= Units, Totaliser 1
Definition of designation for resettable Totaliser 1
Select: kg / t

=Dec Pt, Total2 = Decimal point, Totaliser 2
Definition of the position of the decimal point within the 6 digits display of Totaliser 2
Select: 000000 / 00000.0 / 0000.00 / 000.000

=Units, Total2 = Units, Totaliser 2

Definition of designation for resettable Totaliser 1
Select: kg / t

=Tacho ip= Tacho input source

Select: Tacho - Tacho frequency is read from tacho input
Inv - Tacho frequency is read from inverter (Inverter must be Connected to controller via rs485

=Fixed_Freq= Frequency input source

Select: Yes - Tacho frequency is simulated internally to Nominal tacho frequency
NO - Tacho frequency is read from tacho input

=Tacho Freq = Nominal tacho frequency

Input: 0-2500 Hz (Only used for fixed frequency = "No")

=Max Load= Limit maximum load

Maximum limiting value causing error message "Overload Alarm"
Input: Numerical value in %

=Min Load= Limit minimum load

Minimum limiting value causing error message "Underload Alarm".
Input: Numerical value in %

= Date =

The date can be changed through this parameter.
Input: Numerical value in format DD

=Month =

The date can be changed through this parameter.
Input: Numerical value in format MM

= Year =

The date can be changed through this parameter.
Input: Numerical value in format YY

=Hour=

The system time can be changed through this parameter
Input: Numerical value in format HH

=Minute=

The system time can be changed through this parameter
Input: Numerical value in format MM

=Second=

The system time can be changed through this parameter
Input: Numerical value in format SS

=Password Old=

Enter old password here.
Default password is '0000'.

=Password New=

This parameter is used to change old password.
Default password is '0000'.

4.2.2 Configuration (Configuration Parameters)

= Prefeeder = Prefeeder option
Select: Yes = Weigh feeder/solid flow feeder with pre-feeder option.
No = Weigh feeder/solid flow feeder without pre-feeder
= PreHopper = PreHopper option
Select: Yes = Weigh feeder/solid flow feeder with pre-hopper and control measuring
No = Weigh feeder/solid flow feeder/solid flow feeder without pre-hopper
= Rev Time = Belt revolution time
Time for one revolution of the belt with nominal tacho frequency.
Input: Numerical value in 0.1 s step

=Zero Limit= Zero correction limit
This parameter determines the number of percentage points by which the zero correction value may differ from the zero value. If the difference is greater, the error message "CORR.>SET-LIMIT!" is displayed and the zero value calculated is discarded.
Input: numerical value in %

=Belt track= Belt tracking monitoring time
Time for monitoring the belt tracking input.
Input: numerical value in 0,1 sec. steps

=Run Time= Tacho supervision time
Time for monitoring the tacho input pulses.
Input : 0-999.9 s in 0.1s steps
(No monitoring with input "0")

=Pulse1=Impulse Output 1
The impulse output can be assigned to Totaliser 1, Totaliser 2 or kept Off. Select: Off / S1 / S2

=Pulse Width=Impulse ON time

The impulse ON time can be set using this parameter.
Select: 50mS / 100mS / 250mS / 500mS

=Pulse2=Impulse Output 1

The impulse output can be assigned to Totaliser 1, Totaliser 2 or kept Off.
Select: Off / S1 / S2

=AI Nos= Number of analog i/p

Number of analog i/p depends on cards attached
Select: 1/2/3

=AO Nos= Number of analog O/p

Number of analog O/p depends on cards attached
Select: 1/2/3

=PI=

Selects the control mode for WF drive. Selecting "Analog" selects PI control action. Selecting "Relay " selects "Relay control" action for WF drive control. In this mode, the drive setpoint is automatically adjusted by the controller based on an internal algorithm.
Select: Analog / Relay

Note: When Relay selected, Outputs O000 and O001 are fixed as Forward & Reverse Flow Control Gate outputs

=AO1 value= Analog output1 value

Definition of analog output type at AO1
Select: TPH/BB/Tacho /WFsp/PFsp/Hop_Levl/ Valave_Postn

=AO2 value= Analog output1 value

Definition of analog output type at AO1
Select: TPH/BB/Tacho /WFsp/PFsp/Hop_Levl/ Valave_Postn

=AO3 value= Analog output3 value

Definition of analog output type at AO2
Select: TPH/BB/Tacho /WFsp/PFsp/Hop_Levl/ Valave_Postn

NOTE :
TPH - Actual Material Flow rate
BB - Instantaneous Belt Load
Tacho - Weigh feeder/solid flow feeder Tacho frequency (Belt speed)
WFsp - Weigh feeder/solid flow feeder drive Setpoint
PFsp – Pre-feeder drive Setpoint
Hop_Levl – Hop Level
Valave_Postn –Dosing Gate Position

=Load Limit 1= Limit value 1

The potential free output for Belt load value above this value.
Select: Numerical value in %

=Load Limit 2= Limit value 2

The potential free output for Belt load value above this value.
Select: Numerical value in %

=Load Delay= Hysteresis time

Time after which the output goes high when Belt load remains above limit values 1 or 2,Max Load and below Min Load
Input: Numerical value in 0.1 sec steps.

=Clear Total2 =Clear Totaliser2

Clear Totaliser2 value
Input: No / YES

= Mode Select =

This parameter defines the selection for switching between Interlock/De-Interlock & Gravimetric / Volumetric modes. Selecting "External" defines mode selections from external digital inputs (Using Markers M007 & M015). Selecting "Internal" defines mode selections through keypad.
Select: Int / Ext

= A/D Conversion Rate = Analog to Digital conversion rate

Select Analog to Digital Converter Sampling rate (Recommended : 50)
Input: 6.25 / 12.5 / 25 / 50 / 100 / 200

= Filter Order = Filter Order

Select Order of the low pass filter (Recommended: 3)
Input: 01/2/3/4

= Cut off Freq =Cut off Frequency

Enter the Cut off frequency of the low pass Bessel filter (Recommended : 02.0)
Input: 0.0 to 99.9

= LC Filter = Load Cell Filter

Provides Loadcell input signal filtering. (Recommended : 2)
Select: 0/ 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 steps

4.2.3 Hopper Par

This menu is displayed only if =PreHopper= is selected as 'Yes' in "Configuration menu"

=Hopper Capacity= Nominal Hopper capacity

Input: Numerical value of capacity

=NO Rev= No of belt rev used in auto calibration
Input: Numerical

= Filter Order = Filter Order
Select Order of the low pass filter(Recommended : 3)
Input: 01/2/3/4

= Cut off Freq =Cut off Frequency
Enter the Cut off frequency of the low pass Bessel filter (Recommended : 02.0)
Input: 0.0 to 99.9

= LC Filter = Load Cell Filter
Provides Loadcell input signal filtering. (Recommended : 2)
Select: 0/ 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 steps

= Limit_Low = Hopper Limit value nominal
Marker M080 set high, if Hopper level below this limit
Input: Numeric val in %

= Limit_Nominal = Hopper Limit value nominal
Marker M081 set high, if Hopper level below this limit
Input: Numeric val in %

= Limit_Max = Hopper Limit value maximum
Marker M082 set high, if Hopper level below this limit
Input: Numeric val in %

=Limit Delay= Hysteresis time
Time after which the output goes high when Belt load remains below hopper limit values.
Input: Numerical value in 0.1 sec steps.

4.2.4 Communication

=Inv1= Select Inverter type

Inverters can be connected to controller's serial interface. When connected to serial interface, drive setpoint, start/stop, feedback signals are exchanged between controller &Inverters via the serial interface only.

Select: OFF/ATV312/ PF4M/ACS550/J1000

=Inv2= Select Inverter type
Inverters can be connected to controller's serial interface. When connected to serial interface, drive setpoint, start/stop, feedback signals are exchanged between controller &Inverters via the serial interface only.
Select: OFF/ATV312/ PF4M/ACS550/J1000

NOTE :

i) The address for each Inverter interfaced with controller should be separate. Address for Inverters are fixed and are as follows

a) Inv1 = 2 ,

b) Inv2 = 3 ,

iii) Controller communicates with Inverters at 19200 baud, 8 bits, 1 stop, NO parity.

=SIO Interface= SIO Interface

Selection of the peripheral device at SIO module

Select: Off / Modbus-RTU/ Modbus-RTU/ Modbus-TCP/Profibus-DP

=SIO Baud rate= SIO baud rate

Setting the baud rate for Modbus-RTU

Select: 19200 /38400 / 57600 baud

=SIO Setup= SIO data format

Definition of data format for Modbus-RTU

Select: 8-1-Np, 8-1-Ep, 8-1-Op

Note: 8: data bits, 1: Stop bit, Parity: NO, Even, Odd.

=SIO Address=SIO address

Address of controller when connected to a multi-drop bus on the for Modbus-RTU

Input: Numerical value from 00-99.

=SIO Monitor= SIO monitoring time

Monitoring time for communication.

Input: Numerical value in 1 sec. steps

Note: IF "00" selected, SIO communication monitoring is disabled. In systems, where "Remote Interlock" mode of operation is used, i.e. Setpoint& Start/Stop through SIO, this parameter should not be set to "00".

=IP Address1=Modbus-TCP address octet 1

IP Octet 1for Modbus-TCP

Input: Numerical value from 001-126.

= IP Address2= Modbus-TCP address octet 2

IP Octet 2 for Modbus-TCP

Input: Numerical value from 000-255.

= IP Address3= Modbus-TCP address octet 3

IP Octet 3 for Modbus-TCP

Input: Numerical value from 000-255.

= IP Address4= Modbus-TCP address octet 4

IP Octet 4 for Modbus-TCP

Input: Numerical value from 001-254.

= Node Address= Profibus-DP Node address

Address of controller when connected to a multi-drop bus on the for Profibus-DP
Input: Numerical value from 00-99.

= Profibus Baud = Profibus Baud rate

Setting the baud rate for Modbus-RTU
Select: 9.6kbps/19.2kbps/45.45kbps/93.75kbps/187.5kbps /500kbps/1.5Mbps/3 Mbps/6Mbps/12Mbps (Recommended 1.5Mbps)

4.2.5 Loadcell Cal (Loadcell Calibration)

Select Channel?
Channel 1 is WF Loadcell &
Channel 2 is Hopper Loadcell
Note: Channel 2 is enabled only if “Pre Hopper=Yes”
Press UP/Down keys to select Loadcell

Once selected, press 'Enter' to enter in that channel calibration routine. Pressing 'Return' key will exit the menu without recalibration.
Following window open:

Select Channel: Channel1? <> Channel2?

4.2.5.1 **Channel 1 Loadcell Calibration:**

Step 1: Recalibrate?

Calibration is initiated by the following procedure,

Press 'Enter'. Pressing 'Return' key will exit the menu without recalibration.

Following window open

Calibration Clear Old data & Start new Calib? -> YES, Return-NO

Step 2: Tare Calibration

The Zero % Load is displayed in window. Press 'Enter' key to switch further. Pressing 'Clear' key will exit the menu without recalibration. If 'Enter' key pressed

Then Following Window will open

Tare Calib OK Down –Next

Press '↓' key to switch further.

Step 4:

Enter calibration load value using numeric keys. The Belt Load corresponding to load is displayed in terms of internal calibration counts.

Press '↓' key to switch further. After Pressing '↓' following window will open

Press "ENTER" Key to accept span count value

Loadcell Calib Load = 060.00 % Wt = xxxxxx Press – Enter

Note:
The recommended calibration weight is 60 to 100% of the Max Belt Load value. A calibration error will result if in-sufficient weight is used

Step 5: Complete Calibration

Press 'Enter' key to complete Calibration if calibration Load value is greater than tare load value then Following window will open.

```
Loadcell Calib
Loadcell Calib OK
Wt = xxxxxx
0-9, Ver. –Span
```

Press any Key to exit from channel 1 calibration

If tare Load value is greater than span load value then following window will open.

```
Loadcell Calib
Loadcell Calib Error
Any Key – Exit
```

Press any Key to exit from channel 1 calibration

Step 6: Exit Loadcell Calibration

After pressing any key Following window will open .

```
Select Channel
Channel 1? <>
Channel 2?
```

Press "RETURN" to exit from Loadcell Calibration routine

4.2.5.2 **Channel 2 Loadcell Calibration :**

Step 1: Recalibrate?

Calibration is initiated by the following procedure,
Press 'Enter'. Pressing 'Return' key will exit the menu without recalibration.
Following window open

```
Calibration
Clear Old data &
Start new Calib?
-> YES, Return-NO
```

Step 2: Tare Calibration

The Zero % Load is displayed in window. Press 'Enter' key to switch further. Pressing 'Clear' key will exit the menu without recalibration. If 'Enter' key pressed Then Following Window will open

Tare Calib OK Down –Next

Press '↓' key to switch further.

Step 4:

Enter calibration load value using numeric keys. The Belt Load corresponding to Calibration load is displayed in terms of internal calibration counts.
Press '↓' key to switch further. After Pressing '↓' following window will open
Press "ENTER" Key to accept span count value

Loadcell Calibr Load = 060.00 t/kg Wt = xxxxxx 0-9 ,Ver - Span

Note:

The recommended calibration weight is 60 to 100% of the Max Belt Load value. A calibration error will result if in-sufficient weight is used

Step 5: Complete Calibration

Press 'Enter' key to complete Calibration if calibration Load value is greater than tare load value then Following window will open.

Loadcell Calib Loadcell Calib OK Wt = xxxxxx 0-9, Ver. –Span

Press any Key to exit from channel 2 calibration

If tare Load value is greater than span load value then following window will open.

Loadcell Calib Loadcell Calib Error Any Key – Exit

Press any Key to exit from channel 1 calibration

Step 6: Exit Loadcell Calibration
After pressing any key Following window will open .

```
Select Channel
Channel 1?
Channel 2? <>
```

Press “RETURN” to exit from Loadcell Calibration routine

4.2.6 AI Cal (Analog input calibration)

Step 1: AIO re-calibration
The calibration menu is released on selecting 'Enter' for this parameter. Pressing 'Return' key will not affect the existing values stored in memory and Exit form Menu.
Selection: ENTER / RETURN

```
AI-Calibration
Re-Calibrate?
->YES, Return-NO
```

Step 2: Analog intput channel selection
As there are three analog intputs depends on AI Nos parameter, we can select any one out of three by pressing '↑' & '↓' key. To Enter into particular channel use 'Enter' key & Enabling of that channel is must via AI Nos.
Selection: ENTER / '↑' / '↓'

```
Select Channel:
Channel1? <>
Channel2?
Channel3?
```

Step3: AIO X Min. value
With the analog input at the minimum value, Press '↓' key to accept the value as Min value and switch further.
Note X =1 / 2 / 3

```
Channel X Calib:
Min Value:
xxxx
```

Step3: AIO X Max. value

With the analog input at Max value press '↓' key to accept the Max value.

Channel X Calib Max Value: xxxx

Step4: Complete Calibration

Press 'Enter' key to Exit

1) If Max value is greater than Min Value following window will open

AI Calib OK Press Enter

2) If Min value is greater than Max Value following window will open

AI Calib Error Press Enter

Step 5: Exit from Calib

'Return' key is used to Exit from AI Calibration routine

Select Channel: Channel1?<> Channel2? Channel2?

4.2.7 AO Cal (Analog output calibration)

=Step 1 = Analog output re-calibration

The analog output calibration menu is released on selecting " Enter' for this parameter. 'Return' key will not affect the existing values stored in memory and Exit form Menu.

Selection: ENTER / RETURN

AO-Calibration Re-Calibrate? ->YES, Return-NO

Step 2: Analog output channel selection

As there are three analog outputs depends on AO Nos, we can select any one out of three by pressing '↑' & '↓' key. To Enter into particular channel use 'Enter' key.
Selection: ENTER / ↑ / ↓

Select Channel: Channel1? <> Channel2? Channel3?

Step 3: Analog Output Min. value

This is used to adjust the minimum output value as per selection of channel at the Analog output . The present analog output count value is displayed in the display 3rd line. Press '↑' key to increase & '↓' key to decrease the analog output value. Press 'Enter' to save value and proceed further.

Channel x Calib: Min_Count: XXXX

Step 4: Analog Output Max. value

This is used to adjust the maximum output value as per selection of channel at the Analog output. The present analog output count value is displayed in the display 3rd line. Press '↑' key to increase & '↓' key to decrease the analog output value. Press 'Enter' to save value and proceed further.

Channel x Calib: Max_Count: XXXX

Step 5: Exit from Calib

'Esc' key is used to Exit from AO Calibration routine

Select Channel: Channel1? <> Channel2? Channel3?

4.2.8 **Performance Parameters**

This menu allows access to the PI regulator of the system. The P-share of the regulator is represented by =Prop Gain= and the I-share by =Int Time=.
Note: This menu has access in both online and offline menus

=Int Time=
"I" time of the PI regulator for belt speed setpoint. If this value is zero, the "I" part is ignored in the regulator action.
Input : Numerical value in 0,1 sec steps

=Prop Gain=
"P" part of the PI regulator for belt speed Setpoint.
Input : Numerical value in 0,1 steps

=Dev Limit =Deviation Limit
Tolerance range around the actual flow rate.
Input : Numerical value in percent

=Dev Time=Deviation Time
Maximum time that the actual flow rate is allowed to remain outside the tolerance range. At the end of this time, the scale trips due to "Deviation" error.
Input : Numerical value 0,1 sec steps

=Dead Band=
% Error band for which no control action takes place on the drive Setpoint.
Input : Numerical value 0,1 % steps

=Min_Pulse=
Minimum Pulse_On_Time value. The Forward / Reverse dosing output is made 'ON' only if the ON_Time calculated is greater than the Min_Pulse time value specified. The Forward / Reverse dosing output remains de-energised till this value is reached.

Input : Numerical value 0,1 sec steps

=Regulation = WF_Set / Drive_Set
This parameter selects the control action of 2nd regulator.
Select,
WF_Set : Pre-feeder drive setpoint tracks the current WF setpoint,Cur_Sp
Drive_Set : Pre-feeder drive setpoint tracks the WF drive setpoint

=Reg Tracking=
When WF_Set or Drive_Set is selected for parameter =Regulation=, pre-feeder drive setpoint tracks the selected variable by a multiplying factor defined by this parameter.
Input : Numerical value % steps

=BL Limit=

Used for Pre-Feeder with "Yes" mode selected. When Belt Load value is less than this value, the pre-feeder is started with a fixed setpoint, for time defined by parameter =PF_Delay=. After this time period, the setpoint value changes as per the 2nd PI regulator settings. The initial setpoint for Pre-feeder is defined by parameter =PF StartSet=.
Input: Numerical value % steps

=PF Delay =

Description as above
Input: Numerical value 0.1 Sec steps

= PF StartSet=

The initial setpoint for Pre-feeder is defined by parameter =PF StartSet=.
Input: Numerical value

= PF Limit=

Multiplying factor for limiting maximum setpoint to Pre-feeder drive.
Set value equal to 100,0 % for maximum PF setpoint equal to 10 Vdc; set correspondingly lower values for clamping maximum PF setpoint value.
Input: Numerical value % steps

Note: This menu has access in both online and offline menus

=Cor Factor =

Used to adjust flow rate .
Input: Numerical value

Note: This value must be between 0.9000 to 1.1000

4.2.9 **Setpoint**

This menu allows access to Setpoints effective in different modes. The actual Setpoint for system operation is dependent on the operational mode.

Note: This menu has access in both online and offline menus

= Int_Sp = De-Interlock - Gravimetric Setpoint

Setpoint W1, can be entered in the units and decimal pt selected in config.

Input : Numerical value,4 digit number

= Man_Sp= De-Interlock-Volumetric (Manual) Setpoint

Setpoint Wm, can be entered in the units and decimal pt selected in config.

Input : Numerical value, 4 digit number

Note: This menu has access in both online and offline menus

4.2.10 **Sync (Upload & Download Parameters)**

This menu is used to upload or Download parameters of controller . PC with HyperTerminal (Serial Terminal application) is required.

=Upload= Upload parameters

Uploads parameters from controller to PC

=Download= Download parameters

Downloads parameters from PC into controller

Step 1:

The Sync menu is released on selecting ' ENTER' for this parameter. 'RETURN' key will not affect the existing values stored in memory and Exit form Menu.
For selecting upload or download use '↑' & '↓' keys from keypad
Selection: ENTER / RETURN / ↑ / ↓

```
1 Upload <>
2 Download
Return – Exit
```

Step 2: Upload

Press ENTER' key to enter upload menu. Following window will appear

```
Uploading
@9600
```

Once uploading done on Hyper Terminal , window will automatically update and following window will appear. Press 'RETURN' key to exit from Sync menu.

```
Uploaded
Successfully
Return – Exit
```

Step 3: Download

Press ENTER' key to enter Download menu. Following window will appear

```
Downloading
@9600
```

Once downloading done window will automatically update and following window will appear. Press 'RETURN' key to exit from Sync Menu

```
Downloaded
Successfully
Return – Exit
```

Download Steps Via Hyper Terminal:

Step 1 : In Hyper Terminal Software click on "Transfer"
Step 2 : Then click on "Send Text File"
Step 3 : Then Select file "WF Parameter List _V1.6 .txt"

Note: Parameters must be proper format

If Not in Proper format error will be displayed on screen as well as on hyper terminal

4.2.11 IO Monitor

This menu displays the status of Digital Inputs, Digital Outputs, Markers and Timer bits.

```
Input_status
I00_ 0 ■ ■ ■ ■ ■ ■ 7 ■ ■
I01_ ■ ■ ■ ■ 4 ■ ■ ■ ■ 9
I02_ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■
I03_ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■
```

Bit status '0' is indicated by '■' and Bit status'1' is indicated by the corresponding bit number.

Example:

In the above display, I000, I007, I014 &I019 are with status '1' while all remaining bits are with status '0'

Use '↑' & '↓' keys to switch the display to next block

Press 'Return' to exit .

Note: This menu has access in both online and offline menus

4.3 **Online Screen**

The display in the Online mode can be switched directly by using keys 'Set Point', 'Feed Rate', 'Belt Load', 'Belt Speed','Total1' and ,'Total2'. Other parameters are called by using '↑' & '↓' key. At the Upper left corner of display, Start/Stop status displays and at the upper right corner Modes of machine displays as Man / Int / Ext/Rem.

The following parameters can be displayed in this mode,

TPH	Actual Feedrate value in units selected
S1	Totaliser1 value
S2	Totaliser 2
Load	Belt load value in %
Tacho	Weigh feeder/solid flow feeder Tacho frequency in Hz.
Int_Sp	Un-Interlocked Setpoint
Ext_Sp	Interlocked Setpoint
Com_Sp	Remote, Interlocked Setpoint
Man_Sp	Manual mode Setpoint
Cur_Sp	Current Setpoint
Dev	Deviation in %
WF_SP	WF drive Setpoint in %
PF_SP	PF drive Setpoint in %
Hopper	Current Hopper Load. Dec Pt & Units of hopper is same as S1
Postn	Gate Position
Hop_Totl	Hopper Level reduction during Auto Calibration
FDR_Totl	Feeder Totaliser during Auto Calibration
CM_Diff	Difference between HOP_Totl & FDR_Totl
CM%	Control Measurement Error in %

4.4 **Zeroing**

Since the belt conveyor scale shows system related oscillation around the zero position, the zero point is corrected during one belt revolution in order to improve the measuring precision.
The deviation of the zero point is measured and stored with a plus or minus prefix. This value is used to correct the momentary load during each measuring cycle.

Zeroing can be started with the system in "Manual" mode and in "Start" condition.
Press "Zeroing" key to initiate the zero correction cycle.

When zeroing is in progress, deviation of zero point is displayed continuously. At the end of the zero correction cycle, the average deviation is displayed in percent. If the deviation is greater than the =Zero_limit= parameter, an error message is displayed and the value calculated is discarded. Zero correction has to be repeated.

Press "Zeroing" key to stop zeroing in progress.

4.5 **Auto Calibration**

Feeders with pre-hopper scale can be selected to operate as a "Control Measurement" system.
In this mode, material conveyed by the feeder for a fixed time can be compared with the amount of material extracted from the hopper for the same time period. The difference between can be measured and used to correct the feeder calibration automatically.

Auto calibration (CM) can be started with the system in "Gravimetric" mode and in "Start" condition. Press " ZEROING " key to initiate the Auto calibration cycle. Screen will display "ACAL In progress" at last line.

When CM is in progress, "FDR_Totl"-Material conveyed by feeder and "HOP_Totl"-Material extracted from Hopper are displayed continuously. At the end of the Auto Calibration cycle the following results
are calculated and displayed,
"CM_Diff" – Difference between "FDR_Totl" and "HOP_Totl"
"CM%" – Control Measurement error in %.

The feeder calibration can be corrected on the basis of the error value calculated by pressing the  key. The correction is applied to Feeder 'Tare' value. Screen will display "ACAL OK" at last line if within limit.

If deviation is greater than the =Zero_limit= parameter, an error message is displayed and the value calculated is discarded. Screen will display "ACAL > Limit" at last line.

Press "ZEROING" key to stop Auto calibration in progress. Screen will display "ACAL Abort" at last line

Auto Calibration can also be initiated and controlled through Digital I/O.

5.0 MENU OPERATIONS

5.1 General

The Parameters are entered using the keypad and display. The arrangement of parameters within the menus, options available for each parameters and writing the parameters are explained in the commissioning instructions.

5.1.1 Parameter saves

The parameters of the system are stored in an EEPROM..
The parameters in a menu are automatically saved when the display is scrolled to display the next parameter.

When the Online menu "Online Screen" is called, the parameters set in various menus are checked for logical settings. In case of mismatch, error message is generated. The corresponding parameter should then be correctly set.

5.2 Parameter Menus

The menu structure is divided into 2 categories,

5.2.1 OFFline parameters

These parameters can be changed only when the measuring mode is "OFF".

5.2.2 Online parameters

These parameters can be changed even when the system is in operation.

5.2.3 Parameter Label

A differentiation is made between 2 types of parameters:

Parameter label		Display
1.	Parameter whose value is entered numerically	xxxxx
2.	Parameter whose value is selected from a list	Selection →

5.2.4 **Menu structure**

The parameters are arranged in different menus. The menus and the parameter listing is as shown below.

- System Parameters
  - Units, Capacity
  - Decimal point, Capacity
  - capacity
  - Decimal point, Total1
  - Units, Total1
  - Decimal point, Total2
  - Units, Total2
  - Tacho ip
  - Fixed Freq
  - Tacho Freq
  - Max Load
  - Min load
  - Date
  - Month
  - Year
  - Hour
  - Minute
  - Second
  - Password old
  - Password new
- Configuration
  - Pre-feeder
  - PreHopper
  - Rev Time
  - Zero Limit
  - Belt Track
  - Run Time
  - Pulse 1
  - Pulse Width
  - Pulse 2
  - AI Nos
  - AO Nos
  - PI
  - AO1 Value
  - AO2 Value
  - AO3 Value
  - Load Limit 1
  - Load Limit 2
  - Load Delay
  - Clear Total2
  - Mode Select
  - A/D Converter

- Filter Order
- Cut Off Freq
- LC Filter

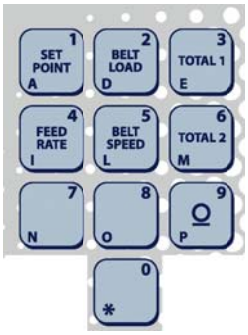
- Hopper Par
  - Hopper Capacity
  - No Rev
  - Filter Order
  - Cut Off Freq
  - LC_Filter
  - Limit_Low
  - Limit Nominal
  - Limit_Max
  - Limit_Delay
- Communication
  - Inv1
  - Inv2
  - SIO Interface
  - SIO Baud rate
  - SIO Setup
  - SIO Address
  - SIO Monitor
  - IP Address1
  - IP Address2
  - IP Address3
  - IP Address4
  - Node Address
  - Profibus Baud

- Loadcell Cal
  - Clear Old data & Start new Calib?
  - Tare_Calibration
    Wt = xxxxxx
  - Load = 030.0 %
    Wt = xxxxxx
- AI Cal
  - Re-Calibrate?
  - Min_Value
  - Max_Value
- AO Cal
  - Re-Calibrate?
  - Min_Value
  - Max_Value

- PLC Program
- Performance Parameter
    - Int Time
    - Prop Gain
    - Dev Limit
    - Dev Time
    - Dead Band
    - Min_Pulse
    - Regulation
    - Reg Tracking
    - BL Limit
    - PF Delay
    - PF StartSet
    - PF Limit
    - Cor Factor
- Setpoint
    - Int_Sp
    - Man_Sp
- Sync
    - Upload
    - Download
- IO Monitor-Display I,O,M,T variables status
- Online Screen
    - Display Actual Flow rate, TPH
    - Display S1
    - Display S2
    - Display Belt Load, Load
    - Display WF Tacho Frequency, Tacho
    - Display Internal Setpoint, Int_Sp
    - Display External Setpoint, Ext_Sp
    - Display Setpoint Communication, Com_Sp
    - Display Manual Setpoint, Man_Sp
    - Display Current Setpoint, Cur_Sp
    - Display Deviation, Dev
    - Display WF drive Setpoint, WF_SP
    - Display PF drive Setpoint, PF_SP
    - Display Hopper load, Hopper
    - Display Gate Position in %(For flow control Gates), Postn
    - Display weighed qty during auto calibration, Hop_Totl
    - Display qty deducted during auto calibration, FDR_Totl
    - Display difference between Hop_Totl & FDR_Totl, CM_Diff
    - Display Auto calibration error in %, CM%

See "Commissioning Instructions" for descriptions of each parameter.

5.2.5 **Keys inside the menu**

	Enter - Selection of options from list.
	Down -Scroll Menu / parameter list being displayed.
	UP -Scroll Menu / parameter list being displayed.
	RETURN - Used to exit and save from online / Offline menu. -Used in combination with 'CL' to exit from PLC Editor - Used to accept values modified in the online / Offline menu.
	CLEAR -In Offline menu ,to exit from Loadcell calibration
	SELECT -Call Online / Offline menus within Online Screen
	Numerical data input from the keypad

5.2.6 **Menu operation Example**

Example: Change the Units of WF Capacity Decimal Pt position 0000 to 000.0 in the System parameters menu.

STEP 1 Enter Offline menu by Pressing ' Select ' key. Following window will open.

```
Main Menu:
>1 System Parameters
  2 Configuration
  3 Communication
  4 Loadcell Cal
```

STEP 2 Press 'HOR' key to Enter into System Parameters menu. Following window will open.

```
1 System Parameters
   Units Capacity
   Kg/h
```

STEP 3 If you want to change Units Capacity then, press 'Enter' key to select "Units Capacity" between Kg/h or t/h. Otherwise press 'Down' key to scroll down to next parameter which is "Dce Pt, Capacity "Following window will open.

```
1 System Parameters
  Dec Pt, Capacity
    0000
```

STEP 4 Press 'Enter' key to change Decimal Pt from 0000 to 000.0 . Following window will open.

```
1 System Parameters
   Dec Pt, Capacity
    000.0
```

STEP 5 Press 'Return' key to exit from System Parameters menu. Following window will open.

```
Main Menu:
>1 System Parameters
  2 Configuration
  3 Communication
  4 Loadcell Cal
```

STEP 6 Press 'Return' key to exit from Offline menu and this will save all changes done in offline menu.

6.0 OPERATING INSTRUCTIONS - PLC

6.1 Programmable Logic Controller

6.1.1 Description

Controller has an inbuilt PLC, which is used to control the Digital Inputs, Digital Outputs and Internal Memory Flags (Markers).

The Programmable control system processes the instructions from the control program.

The Input data and Output data for the control program are physically in the Controller RAM, logically in the so called "process images". The instructions in the control program with the variables "I O M T" always refer to the process image in RAM.

The programmable control system continuously operates on the control program in the following sequence,

-Transfer hardware inputs to the Controller RAM

-Execute instructions in the control program

-Transfer output process image to the Hardware Outputs

Several variable types are used in the PLC program. "O" stands for outputs, "I" for inputs, "M" for marker and "T" for timers. Addition of "N" (AN or ON) means that the associated variable is scanned for signal status "0" ; otherwise the scanning of variables is for signal status "1".

6.1.2 PLC Operation

The programmable control system consists of a 1_bit_wide BIT accumulator. Instructions in the PLC can be classified into two types; one type operating on the result of previous instruction (Result Instruction) and second changing the accumulator value (Command instruction).

The control program is always started with accumulator = "1". 'Command' instructions Change the accumulator value till a 'Result' instruction is encountered. After execution of all 'Result' instructions, accumulator is again made '1' and the sequence is continued.

Example:

```
0   AM 045      ;Command Instruction - Accumulator = '1'
1   AM 068      ;Command Instruction - 'AND' result of above
                                       Instr. with M068 value
2   ANI050      ;Command Instruction - 'AND' result of above instr.
                                       with 'NOT ‘of I050 input.
3   =M 008      ;Result Instruction
4   AI 000      ;Command Instruction - Accumulator = '1'
```

:

6.1.3 Instructions

Instruction	Meaning	Command	Result
AI xxx	AND operation with INPUT	Y	N
AO xxx	AND operation with OUTPUT	Y	N
AM xxx	AND operation with MARKER	Y	N
AT xxx	AND operation with TIMER	Y	N
ANIxxx	AND + NOT operation with Input	Y	N
ANOxxx	AND + NOT operation with Output	Y	N
ANMxxx	AND + NOT operation with Marker	Y	N
ANTxxx	AND + NOT operation with Timer	Y	N
OI xxx	OR operation with INPUT	Y	N
OO xxx	OR operation with OUTPUT	Y	N
OM xxx	OR operation with MARKER	Y	N
OT xxx	OR operation with TIMER	Y	N
ONIxxx	OR + NOT operation with Input	Y	N
ONOxxx	OR + NOT operation with Output	Y	N
ONMxxx	OR + NOT operation with Marker	Y	N
ONTxxx	OR + NOT operation with Timer	Y	N
SO xxx	SET Output	N	Y
SM xxx	SET Marker	N	Y
RO xxx	RESET Output	N	Y
RM xxx	RESET Marker	N	Y
RT xxx	RESET Timer	N	Y
=O xxx	Equate Output to result	N	Y
=M xxx	Equate Marker to result	N	Y
LT xxx	Load Timer xxx with value in next Instruction	N	Y
STxxx	Start Timer with xxx sec. in ON-delay mode	N	Y

6.1.4 Inputs, Outputs and Markers

These are one bit variables that can have status "LOW" (Logical 0) or "HIGH" (Logical 1). The differentiation between inputs and outputs is done by the "signal direction" on which these variables are based. Inputs are signals from "outside" to the control program, and outputs are signals from the control program to the external system. Thus inputs can only be read, while outputs can be allocated. Inputs and Outputs are available outside the system with the help of digital I/O card.

Markers are internal variables and serve as memory within the control system. They are available outside the control system when they have been copied onto outputs. Markers are classified into Input Markers and Output Markers. Input markers are used to control the software execution while Output markers are derived as a result of the software execution.

6.1.5 Timers

Ten ON-delay timers are available in the system for timing functions.

Instruction "LT xxx" loads timer "xxx" if the result of previous instruction is "1". Instruction "ST yyy" starts the previously loaded timer with time "yyy".

Timers continue to run till the input condition is "1" or till the set time is over, whichever is earlier. After completion of set time, the respective Timer "Txxx" bit status is made "1".

Timers are reset (Txxx is made "0") with "RT xxx" instruction. Instruction "RT xxx", if executed while timer is running, stops the timer.

6.2 Programming Functions

6.2.1 General

The Programmable Logic Controller in Controller serve to adjust the scale to the plant control logic. The control program can be edited via the keypad and display.

Designation of files in the PLC menu is as follows,

PLCS - Source file containing list of instructions
PLCA - Assembler file after translation from PLCS

6.2.2 Functions

The following functions are available in the "PLC Program" menu,

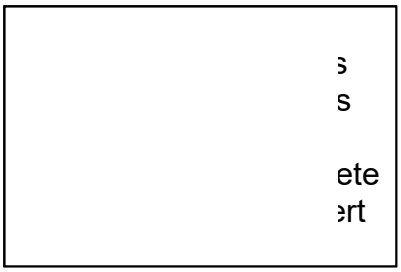
← PLC program lines in memory
← Assembled program size in memory

- Press ‘E’ to edit PLC program
- Press ‘I’ to insert std. PLC program
- Press ‘A’ for assembling PLC program
- Press ‘D’ for deleting PLC program

Key.	Meaning	Function
A	Assemble	Assembles PLCS file to generate PLCA file
D	Delete	Delete PLCS file from memory
E	Editor	Open editor for reading/altering PLCS file
I	Insert	Append a std. PLCS file from EPROM to current PLCA file.
Return+ Clear		Exit Menu

6.2.2.1 Assemble

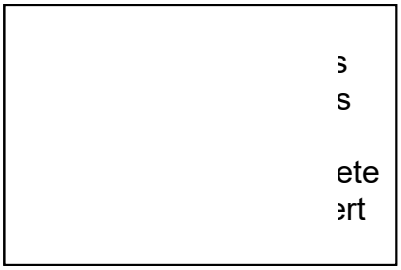
This function is invoked by pressing 'A' in the PLC Editor menu.
After pressing A both PLCS & PLCA must be equal which indicates that PLC program is assembled.



← PLC program lines in memory
← Assembled program size in memory

6.2.2.2 Delete

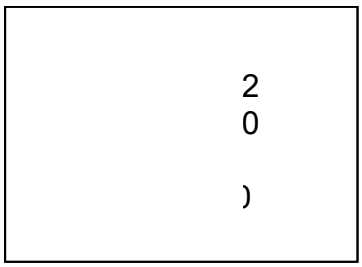
This function is invoked by pressing 'D' in the PLC Editor menu.
After pressing D PLCS becomes 0.



← PLC program lines in memory
← Assembled program size in memory

6.2.2.3 Editor

Press 'E' in the PLC Editor menu, to edit the PLCS file in memory.



← PLC Program

Note : *** is end of line.This must be there at end of every PLC Program

The following functions are available within the Edit option,

Key	Function
Return+Clear	Save and exit
Return + I	Insert Line A blank line or is inserted at the current cursor position.
Return + D	Delete line - The line indicated by cursor is deleted.

Return + ANY OTHER KEY, Cancel "Return" status

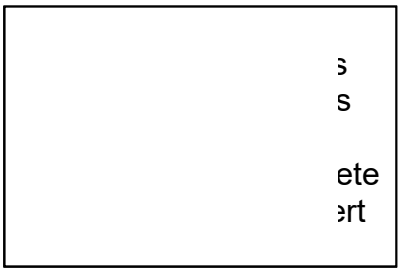
Keys used in this menu,

Key	Function
0 to 9	Numeric entries
A,E,D,I,L,M,N,O,R,S,T,=	PLCS command characters

Key	Function
Up Key	Previous line
Down Key	Next line
Enter	-Scroll to next character position, depending on Return status
Return	Used in combination with other keys.

6.2.2.4 **Insert**

This function is invoked by pressing '**I**' in the PLC Editor menu.
After pressing I Press 0 to 3 keys to insert inbuilt program from EEPROM



← PLC program lines in memory
← Assembled program size in memory

Standard PLCS files are resident in the EPROM memory, which can be used directly. These files are called into memory with the help of this function.

Enter the PLCS file number to be inserted into memory.

6.3 **Allocation of Variable**

The variables are sub-divided into inputs, outputs, markers and timers. Free variables (read Markers) can be used by the control program as general purpose variables.

6.3.1 **Inputs**

I000 to I001	- Controller inputs
I002 to I005	- AIDICOM card Inputs
I006 to I007	- Free
I008 to I011	- DIO Card #1 Inputs
I012 to I015	- DIO Card #2 Inputs
I016 to I023	- Free
I024 to I029	- Inv1 Digital Inputs
I030 to I031	- Free
I032 to I037	- Inv2 Digital Inputs
I038 to I039	- Free

6.3.2 **Outputs**

O000 to O003	- Controller outputs (O001 Forward, O002 Reverse, Dosing vale)
O004 to O007	- AIDICOM card outputs(O004 Totaliser 1, O005 Totaliser 2)
O008 to O011	- DIO Card #1 outputs
O012 to O015	- DIO Card #2 outputs
O016 to O039	- Free

6.3.3 **Markers**

Marker are classified into Input markers (M000 - M039) and Output markers (M040 -M095). Input markers are read by the control program while Output markers are written by the control program. Read access is allowed to both these types of markers.

6.3.3.1 **Input Markers**

Marker	Meaning "1"	Meaning "0"
M000	Start via SIO	
M001	Stop via SIO	
M002	Remote on(Control through SIO)	Remote off(Control through SIO)
M003	Reset Totaliser1	
M004	Free	
M005	Free	
M006	Free	
M007	Gravimetric Mode	Volumetric mode
M008	Local Mode	Remote Mode
M009	Belt Track status-Fault	Healthy
M010	Emergency status- Healthy	Fault
M011	Local Start-WF	
M012	Local Stop-WF	
M013	Local Start-PF	
M014	Local Stop-PF	
M015	De-Interlock Mode	Interlock Mode
M016	Remote Start	Stop
M017	Fault	Downstream Interlock-Healthy
M018	Error Reset	
M019	WF Drive Interlock-Healthy	Fault

M020	PF Drive Interlock-Healthy	Fault
M021	Dosing valve Forward	
M022	Dosing valve Reverse	
M023	Free	
M024	BIN PRE-FEEDER START	BIN PRE-FEEDER STOP
M025	START Auto Calibration	
M026	STOP Auto Calibration	
M027	Accept Auto calibration correction	
M028	Local Start-Vibrator Motor	Stop
M029	(Material Detect switch) Material High	Low

6.3.3.2 **Output Markers**

Marker	Meaning "1"	Meaning "0"
M040	Tacho Fault	Healthy
M041	Belt tracking Fault	Healthy
M042	WF Drive Fault	Healthy
M043	Deviation Fault	Healthy
M044	General Fault	Healthy
M045	PF Drive Fault	Healthy
M045	ZSS FAULT	Healthy
M047-50	Free	
M051	Local Mode	Remote Mode
M052	Gravimetric Mode	Volumetric Mode
M053	Interlock Mode	De-Interlock
M054-55	Free	
M056	Limit1	
M057	Limit2	
M058	Overload Alarm	
M059	Under load Alarm	
M060	Loadcell1 Fault	
M061	Free	
M062	Loadcell 2 Fault	
M063	Free	
M064	WF Start	WF Stop (Blinking if Fault)

M065	PF Start	PF Stop (Blinking if Fault)
M066	WF Start	WF Stop
M067	PF Start	PF Stop
M068	System Healthy	
M069	Vibrator ON	Vibrator OFF
M070-74	Free	
M075	Bin Prefeeder ON	Bin Prefeeder Off
M076	Auto Calibration ON	
M077	Auto Calibration Aborted	
M078	ACAL> Zero_Limit	
M079	Free	
M080	Hopper-Load_MIN	
M081	Hopper-Load_Nominal	
M082	Hopper-Load_MAX	
M083 - M095	Free	

6.3.4 **Timers**

T000 to T009 are timers available for use in the PLCS program.

6.4 Standard Programs and I/O Assignments

6.4.1 Standard Program

```
 0     AI 001              /*belt track i/p*/
 1     =M 009
 2     AI 002              /*down stream*/
 3     =M 017
 4     AI 003              /*Remote start/stop*/
 5     =M 016
 6     AI 004              /*Local /Remote*/
 7     =M 008
 8     AI 005              /*Emergency Stop*/
 9     =M 010
10     AI 006              /*local start*/
11     =M 011
12     AI 007              /*Error ack*/
13     =M 018
14     AM 066
15     =O 000              /*WF Run motor (START/STOP MOTOR) */
16     AM 044
17     =O 002              /*General Fault */
18     ANM010
19     =O 003              /*Emergency Fault Stop*/
20     AM 008
21     =O 004              /*Remote Mode*/
22     ANM008
23     =O 005              /*Local Mode*/
24     AM 009
25     =O 006              /*Belt Track*/
26     AM 068
27     =O 007              /*System Healthy*/
28     AM 066            /*ZSS Program starts here */
29     AI 000             / *If Input I000 is assigned to ZSS and Timer T000 & 30
       LT 000             T001 are set for 10 sec */
31     ST 010
32     AM 066
33     ANI000
34     LT 001
35     ST 010
36     AM 066
37     AT 000
38     OT 001
39     RM 066
40     ANM066
41     RT 000
42     RT 001           /*ZSS Program ends here */
28     ***               /*End of line*/
```

Note: Replace I000 with ZSS input number if other than “I000 “ is used for ZSS

6.4.2 IO Assignments

Digital Inputs

I000 to I001 - Controller inputs
I002 to I005 - AIDICOM card Inputs
I006 to I007 - Free
I008 to I011 - DIO Card #1 Inputs
I012 to I015 - DIO Card #2 Inputs
I016 to I023 - Free
I024 to I029 - Inv1 Digital Inputs
I030 to I031 - Free
I032 to I037 - Inv2 Digital Inputs
I038 to I039 - Free

Digital Outputs

O001to O003 - Controller outputs
O004 to O007 - AIDICOM card outputs(O004 Totaliser 1, O005 Totaliser 2)
O008 to O011 - DIO Card #1 outputs
O012 to O015 - DIO Card #2 outputs
O016 to O039 - Free

Output	High
O000	Forward Flow Control Gate(If PI =YES)
O001	Reverse Flow Control Gate(If PI =YES)
O004	Totaliser 1 out Pulse (Fixed)
O 005	Totaliser 2 out Pulse (Fixed)

7.0 TERMINATIONS

X1

1 – 24P (Supply: 10-30Vdc)
2 – 24N (0Vdc)
3 – Earth
4 – Digital Input 1
5 – Digital Input 2
6 – 24N
7 – Digital Output 1
8 – Digital Output 2
9 – Digital Output 3
10 – Digital Output 4
11 –24V(+)
12 – 12V(+)Tacho Supply(+)
13 – Tacho I/P
14 – 12V(-)Tacho Supply(-)
15 – MA+
16 – MA –

X2 – USB* type A (USB 2.0)

* Requires USB 2.0 TYPE A male to TYPE A male cable

X3 (Loadcell) – DB9 Connector

1 – Earth
2 – MV1 +
3 – MV2 +
4 –Sense+
5 – Loadcell Supply+ (5Vdc)
6 – MV1 -
7 – MV2 -
8 –Sense-
9 – Loadcell Supply- (0Vdc)

X4

1 – Digital Input 3
2 – Digital Input 4
3 – Digital Input 5
4 – Digital Input 6
5 – 24N
6 – Digital Output 5
7 – Digital Output 6
8 – Digital Output 7
9 – Digital Output 8
10 – 24V(+)

11 – A-I/P(+) (10Vdc/ 4-20mA)
12 – A-I/P - (0v)
13 – 1 RS485+
14 – 1 RS485-

X5

1 – 2RS485+
2 – 2RS485-

X6A(AIO#1 Card)

1 – MA+
2 – MA -
3 – A-I/P + (10vdc / 4-20mA)
4 – A-I/P - (0v)

X6B(AIO#2 Card)

1 – MA+
2 – MA -
3 – A-I/P + (10vdc / 4-20mA)
4 – A-I/P - (0v)

X7A(DIO#1 Card)

1 – Digital Output 1
2 – Digital Output 2
3 – Digital Output 3
4 – Digital Output 4
5 – Digital Input 1
6 – Digital Input 2
7 – Digital Input 3
8 – Digital Input 4

X7B(DIO#2 Card)

1 – Digital Output 1
2 – Digital Output 2
3 – Digital Output 3
4 – Digital Output 4
5 – Digital Input 1
6 – Digital Input 2
7 – Digital Input 3
8 – Digital Input 4

8.0 Configuration of Jumpers

Main Board

Jumper J3: 1 – 2

AIDICOM Board

Jumper J1: 1 - 2 → 4-20mA analog i/p
3 - 4 → 0-10vdc analog i/p

Jumper J2: 1 - 2→ Modbus-RTU
3 - 4 → Modbus-TCP/Profibus-DP

AIO Board

Jumper J1: 1 - 2 → 4-20mA analog i/p
3 - 4 → 0-10vdc analog i/p