Australian Government
Department of Industry, Science and Resources

National Measurement Institute

36 Bradfield Road, West Lindfield NSW 2070

Certificate of Approval

NMI 6/14B/31

Issued by the Chief Metrologist under Regulation 60 of the
National Measurement Regulations 1999

This is to certify that an approval for use for trade has been granted in respect of the instruments herein described.

Allied Grain Systems Model CA1000-60K Discontinuous Totalising Automatic Weighing Instrument

submitted by Allied Grain Systems Pty Ltd
41 Rockdale Road
Young NSW 2594

NOTE: This Certificate relates to the suitability of the pattern of the instrument for use for trade only in respect of its metrological characteristics. This Certificate does not constitute or imply any guarantee of compliance by the manufacturer or any other person with any requirements regarding safety.

This approval has been granted with reference to document NMI R 107, *Discontinuous Totalising Automatic Weighing Instruments (Totalising Hopper Weighers)*, dated July 2004.

This approval is subject to review at the decision of the Chief Metrologist in accordance with the conditions specified in the document NMI P 106.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern approved and variant 1 – certificate issued	22/06/23

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 6/14B/31' and only by persons authorised by the submittor.

It is the submittor's responsibility to ensure that all instruments marked with this approval number are constructed as described in the documentation lodged with the National Measurement Institute (NMI) and with the relevant Certificate of Approval and Technical Schedule. Failure to comply with this Condition may attract penalties under Section 19B of the National Measurement Act and may result in cancellation or withdrawal of the approval, in accordance with document NMI P 106.

Auxiliary devices used with this instrument shall comply with the requirements of General Supplementary Certificate No S1/0B.

The values of the performance criteria (maximum number of scale intervals etc.) applicable to the instrument shall be within the limits specified herein and in any approval documentation for the components where they are approved separately.

This approval shall NOT be used in conjunction with General Certificate No 6B/0

Signed by a person authorised by the Chief Metrologist to exercise their powers under Regulation 60 of the *National Measurement Regulations 1999*.

Darryl Hines
Manager
Policy and Regulatory Services

TECHNICAL SCHEDULE No 6/14B/31

1. Description of Pattern approved on 22/06/23

An Allied Grain Systems model CA1000-60K Class 0.2 discontinuous totalising automatic weighing instrument (DTAWI) (Figures 1 and 6) having a weigh hopper of 17 000 kg maximum capacity.

The instrument is installed in a permanently fixed location.

Note: This approval has been granted with reference to document NMI R 107, *Discontinuous Totalising Automatic Weighing Instruments (Totalising Hopper Weighers)*, dated July 2004. The following description is intended to introduce terms used in this Certificate and Technical Schedule which may be additional to those in that document but which are consistent with the terminology in the document.

The system aims to provide a *bulk load delivery* using a particular automatic *delivery sequence* (the term 'delivery' may also be taken to refer to 'receipt').

This sequence involves the totalisation of the results of a number of *discrete load deliveries* or *weighing cycles*, each of which involves the division of the bulk product into *discrete loads*, according to a *target discrete load* the mass of which is then determined by weighing to give the *discrete load delivered* following which the product is discharged to the bulk output. Note that the *target discrete load* may be achieved by stopping or slowing the bulk product delivery prior to the *target discrete load* value being reached according to *discrete load target shutoff adjustments* (such as inflight adjustments or slow flow pre-sets).

Each *discrete load delivered* is totalised (at any time this may be termed the *cumulative totalisation*).

The *target discrete load* is generally a pre-selected value that is the same for most of the *discrete load deliveries* (this may be termed the *pre-selected target discrete load*). However for the final one or two deliveries in the *bulk load delivery* the *target discrete load* may differ (for example to avoid excessively large or small *discrete loads*). In addition, arrangements for stopping or slowing the bulk product delivery prior to the *target discrete load* value being reached may vary for the final discrete deliveries in the delivery sequence according to *target totalised load shutoff adjustments* (such as inflight adjustments or slow flow pre-sets).

The *totalised bulk load delivered* may be intended to be close to a requested amount (*target totalised load*) in which case adjustments and pre-sets as described above may be used to achieve this as closely as possible.

Alternatively the *totalised bulk load delivered* may be the quantity measured without a particular target totalised load.

The *totalised bulk load delivered* is the cumulative totalisation (sum of all discrete loads delivered), in the complete *bulk load delivery*. The transaction is based on the *totalised bulk load delivered* (not the *target totalised load*).

1.1 Details

The CA1000-60K instrument is a class 0.2 discontinuous totalising automatic weighing instrument having a weigh hopper with a maximum capacity of 17 000 kg.

The instrument is approved for use with a minimum totalised load (Σ_{min}) of not less than 10 000 kg and a totalisation scale interval of 10 kg. The instrument has a minimum capacity of 5000 kg, and is set to have a *target discrete load* of from 5000 kg to 15 000 kg.

The CA1000-60K instrument permanently records the *totalised bulk load delivered* and the net value of each discrete load delivered. This information can be sent to a printer if required.

Note: The discrete load values are NOT approved for trade use. The totalised bulk load delivered (a total of the discrete load delivered values) is the value approved for trade use.

1.2 Weighing System

The pattern comprises components as described below.

(a) A weigh bin hopper with out-feed gate (Figure 1a), using four Mettler Toledo model SLS510 load cells of 7500 kg maximum capacity (Figure 1b). The load cells are located symmetrically around the weigh bin hopper.

The load cells are connected parallel to each other in a junction box; and 6-wire cable connection is used between the junction box and the indicator as shown in Figure 7.

(b) A Mettler Toledo model IND570 digital indicator for the weighing system (the indicator is also described in the documentation of approval NMI S727).

(c) A B&R Model X20PC1684 (*) programmable logic controller (PLC – Figure 3), with associated networking and input/output modules.

(d) Bulk Weigher Control System (BWCS) version B4.92 which runs on the programmable logic controller mentioned in (c) above, and utilises the weight readings from the digital indicator to determine the discrete load values and totalises them to determine the *totalised bulk load delivered*, and stores the weighing data.

(e) An operator interface computer by which the operator can control the system, and access the weighing data. (*)

Note: The system may also be controlled and weighing data accessed by other (networked) computers.

(f) A printer (to print transaction data), or equivalent record in electronic form.

(g) Actuators and associated position sensors to control the product in-feed and the out-feed gates for the weigh bin. (*)

(*) For items marked (*) above, ‘Compatible and Equivalent’ equipment may be used. ‘Compatible and Equivalent’ refers to equipment of the same or better specifications, requiring no changes to software for satisfactory operation of the complete system.

1.3 Indicator and PLC Control Arrangements

The BWCS software running on the PLC, along with weight data from the digital indicator, controls the weighing sequence, including checking of various aspects of the system operation (level sensors, blocked chutes and gates open or closed as appropriate) and filling of the weigh-bin by starting and stopping of product flow (opening and closing of in-feed and out-feed gates) according to messages from the plant operator’s control system.

The BWCS software running on the PLC uses inputs from the system to determine when no further product delivery is required (e.g. when the in-feed bin is empty, the out-feed bin is full, or sufficient product has been supplied). In some cases these inputs may be provided by the plant operator's control system (e.g. to indicate that sufficient product has been supplied).

Weight data from the digital indicator is continually provided to the BWCS software which uses this information to determine the discrete load values, totalise them to determine the *totalised bulk load delivered*, and store this weight data.

Where sufficient product has been supplied, the BWCS software finalises the delivery and totalises the discrete load deliveries to form the *total bulk load delivered* value.

The weight data, together with information regarding the weighing sequence status, is also provided continually to the operator Plant Control System (PCS) computer(s). The operator interface computer(s) can retrieve weight data for printing if required.

The system has provision for Manual operation mode in which the gates of the system may be manually operated, outside the normal operation sequence, the product delivery is not totalised. This mode is not approved for trade use.

1.4 Operation

An overview of the sequence of operation of the system is shown in Figure 4 and typical operator screens are shown in Figure 5.

The system is considered to be a discontinuous totalising automatic weighing instrument as it follows a predetermined program of automatic processes characteristic of the instrument. The product is weighed by individual discrete loads, which are totalised to determine the bulk product weighed.

(a) Initially the target discrete load ('batch target') is set in the PLC (generally this will be a fixed value and will not vary between deliveries). The target discrete load may be programmed to different values for different grain types due to the volume of the grain.

The system remains in an idle state until a delivery sequence has been set and a *target totalised load value* entered.

(b) The system will commence filling the weigh hopper via the feed gate until the target discrete load value is reached. The status of the Start signal from the plant operator's control system (PCS) is also monitored as absence of this signal will indicate that product is not available for measurement, in which case the set-point cannot be reached, and the delivery will be finalised.

(c) Once the weigh bin is full (or no further product is available) and the feed gates are closed, the system waits for a stable weight signal (determined by receipt of a stable signal from the indicator), and records the gross weight reading for the loaded weigh bin.

(d) The system checks the status of alarms and inputs and then discharges the product into the lower garner. When the weigh bin is empty, the discharge gates are closed and when the weight reading is stable, the system records the empty ('tare') weight reading for the empty bin.

(e) The gross weight value for the loaded bin at (c), minus the tare weight value for the empty bin at (d) is the discrete load delivered from the weigh bin. This can then be added to values of previous cycles to provide a cumulative

totalised load.

(f) If the Start signal is present – indicating that further product is required, and there are no faults or alarms present – the system will repeat the sequence from (b) to (e).

(g) If the quantity of product required to reach the target totalised load ('shipping target') is less than three times the target discrete load, the system will recalculate the value for each remaining discrete load to avoid attempting to weigh less than the minimum capacity in one cycle.

(h) The gross, tare and net weight for each weighing cycle are permanently recorded in the system database along with a running total of the product weighed. Various reports are available to print (a typical example is shown in Figure 6).

1.5 Verification Provision

Provision is made for the application of a verification mark.

1.6 Sealing Provision

The digital indicator shall be sealed as described in the documentation of approval NMI S727.

1.7 Software

The Bulk Weigher Control System software running on B&R Model X20PC1684 PLC is designated B4.92.

The operator interface Plant Control System software is designated 5.2.5.1.

1.8 Descriptive Markings and Notices

(a) Instruments carry the following markings, grouped together in a clearly visible place on the instrument, either on a descriptive plate fixed near the indicating device or on the indicating device itself:

Manufacturer's mark or name written in full	Allied Grain Systems	
Indication of accuracy class	Class 0.2	
Pattern approval mark for the instrument	NMI 6/14B/31	
Model number	CA1000-60K	
Serial number of the instrument	.....	
Maximum capacity	*Max* = 17 000 kg	(#)
Minimum capacity	*Min* = 5000 kg	(#)
Minimum totalised load (not less than)	Σ_{min} = 10 000 kg	(#)
Totalisation scale interval	d_t = 10 kg	
Material to be measured	.....	

(#) These markings shall also be shown near the display of the result if they are not already located there.

(b) Instruments carry a notice visible to the operator stating TARGET DISCRETE LOAD SHALL BE xxxx kg to yyyy kg ONLY, or similar wording (where xxxx and yyyy are in the range of 5000 kg to 15 000 kg).

Note: Markings for variants vary according to particular characteristics.

2. Description of Variant 1 approved on 22/06/23

The Allied Grain Systems CA1000 instruments in various versions as Class 0.2 discontinuous totalising automatic weighing (DTAW) instruments as shown in Table 1.

Note that the pattern (CA1000-60K) is shown in **bold**.

TABLE 1

Model	CA1000-5K(*)	CA1000-10K(*)	CA1000-20K(*)
Max Capacity (kg)	1400	2400	4600
Min Capacity (kg)	500	1000	1000
Totalisation Scale Interval (kg)	1	2	2
Max Target Discrete Load (kg)	1350	2300	4550
Min Target Discrete Load (kg)	500	1000	1000
Minimum Totalised Load (kg)	1000	2000	2000
Load Cell Capacity (kg)	500	1000	2500
No. of Load Cells	4	4	4

Model	CA1000-30K(*)	CA1000-40K(*)	CA1000-50K(*)
Max Capacity (kg)	6900	10 000	12 000
Min Capacity (kg)	2500	2500	2500
Totalisation Scale Interval (kg)	5	5	5
Max Target Discrete Load (kg)	6850	9500	11 500
Min Target Discrete Load (kg)	2500	2500	2500
Minimum Totalised Load (kg)	5000	5000	5000
Load Cell Capacity (kg)	2500	5000	5000
No. of Load Cells	4	4	4

Model	**CA1000-60K(*)**	CA1000-80K(*)	CA1000-100K(*)
Max Capacity (kg)	**17 000**	19 000	28 000
Min Capacity (kg)	**5000**	5000	7000
Totalisation Scale Interval (kg)	**10**	10	10
Max Target Discrete Load (kg)	**15 000**	18 500	27 500
Min Target Discrete Load (kg)	**5000**	5000	7000
Minimum Totalised Load (kg)	**10 000**	10 000	14 000
Load Cell Capacity (kg)	**7500**	7500	10 000
No. of Load Cells	**4**	4	4

(*) Instruments may be provided with a larger capacity upper garner (‘Extended’ is appended to the model number).

Instruments shall be tested in accordance with any relevant tests specified in the National Instrument Test Procedures.

Where a specific National Instrument Test Procedure for DTAWI does not exist, an appropriate test procedure (e.g., Inspectors Handbook Test Procedure No 22) shall be used and a copy of Test Procedure No 22 should be requested from NMI.

Maximum Permissible Errors

The maximum permissible errors are specified in Schedule 1 of the *National Trade Measurement Regulations 2009*.

Application of Inspectors Handbook Test Procedure No 22 Clause 5.2

Weighing Performance Tests

The following test procedure assesses the weighing performance of the DTAWI with the type of material that it is intended to weigh. The performance tests shall be carried out in accordance with *separate verification method* only.

A minimum of 3 material weighing tests is required as specified below.

Maximum Target Discrete Load

This test procedure assesses the weighing performance operating with maximum target discrete loads.

1. Determine the number of weighing cycles required to deliver the minimum totalised load (Σ_{min}) when operating with maximum target discrete loads (Max_T) as follows:

$$N_{Max} = \frac{\Sigma_{min}}{Max_T}$$

where N_{Max} is rounded up to the next integer.

2. Perform a weighing test with a target discrete load of Max_T and a target totalised load of Σ_{min}.
3. If N_{Max} is less than 5, perform an additional material weighing test with a target discrete load of Max_T and a target totalised load of $5 \times Max_T$.

Minimum Target Discrete Load

This test procedure assesses the weighing performance operating with minimum target discrete loads.

1. Determine the number of weighing cycles required to deliver the minimum totalised load when operating with minimum target discrete loads (Min_T) as follows:

$$N_{Min} = \frac{\Sigma_{min}}{Min_T}$$

where N_{Min} is rounded up to the next integer.

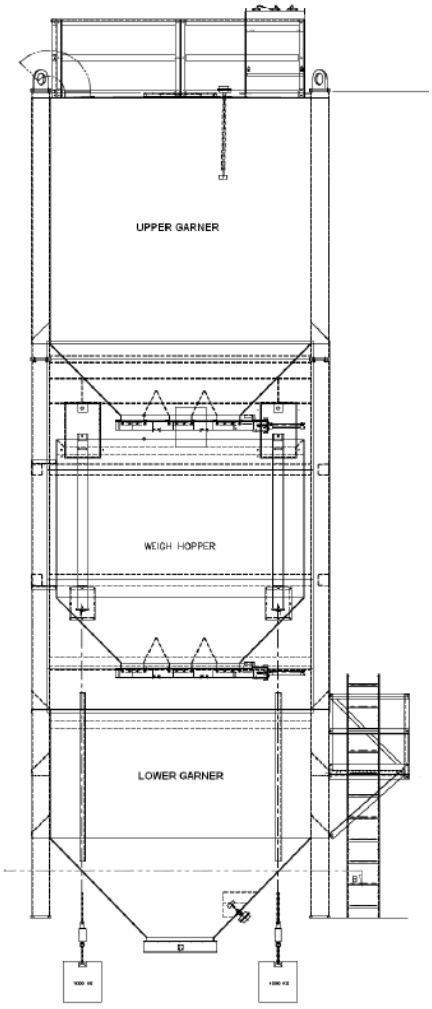
2. Perform a weighing test with a target discrete load of Min_T and a target totalised load of Σ_{min}.
3. If N_{Min} is less than 5, perform an additional weighing test with a target discrete load of Min_T and a target totalised load of $5 \times Min_T$.

Additional Test

In some cases the above procedure may indicate only two tests to be performed. To achieve three material tests in total, perform an additional weighing test with target totalised load of Σ_{min} and a target discrete load value which is standard or typical for the installation. If it is difficult to arrive at a standard value then use Min_T.

Note: For some types of instruments the quantity delivered (target totalised load) must be an integer multiple of the discrete load. In this case unless the minimum totalised load is an integer multiple of the discrete load, it may be necessary to use the next larger possible test load (which is an integer multiple of the discrete load).

FIGURE 6/14B/31 – 1

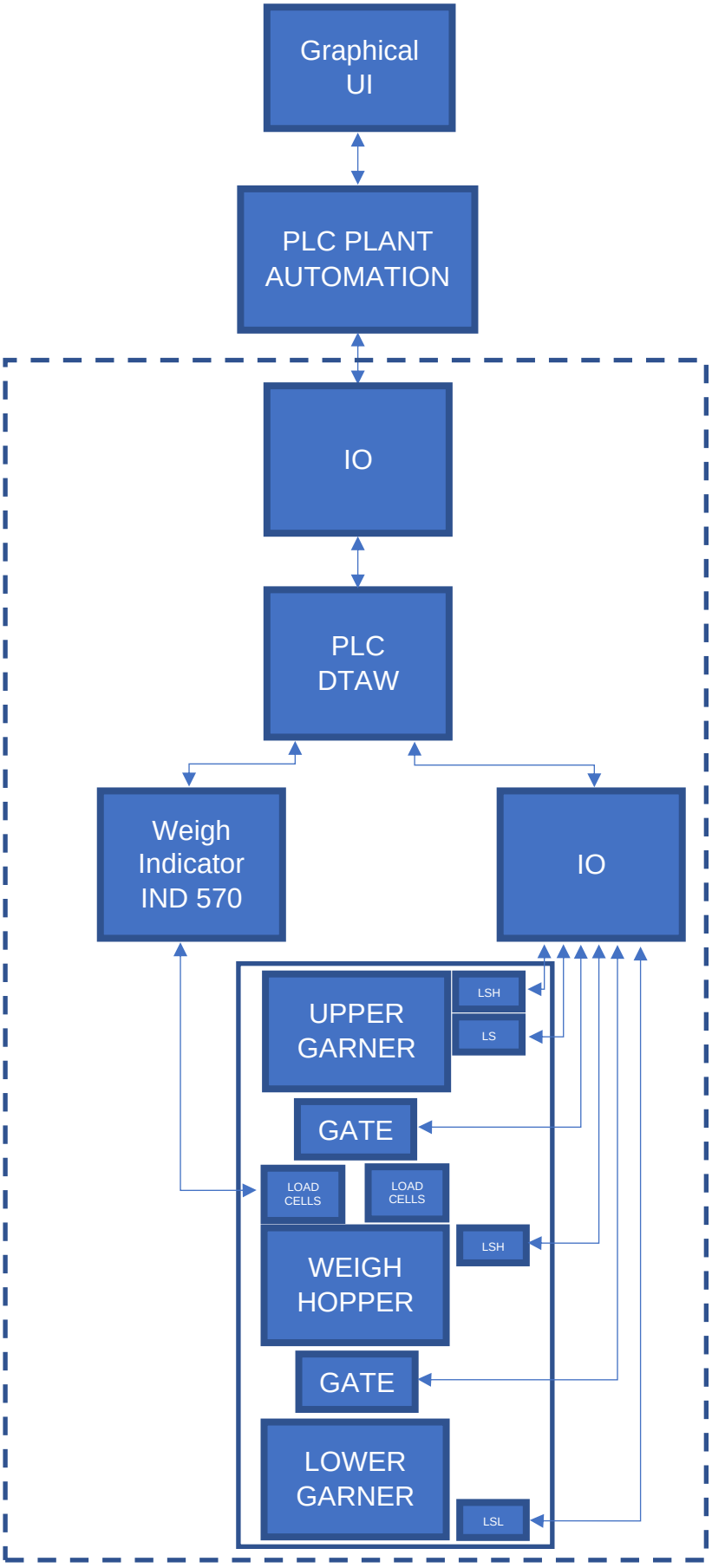


(a) Allied Grain Systems CA1000-60K (The Pattern)

(b) Load Cell & Load Cell Mounting

Allied Grain Systems Model CA1000-60K Discontinuous Totalising Automatic Weighing Instrument

FIGURE 6/14B/31 – 2

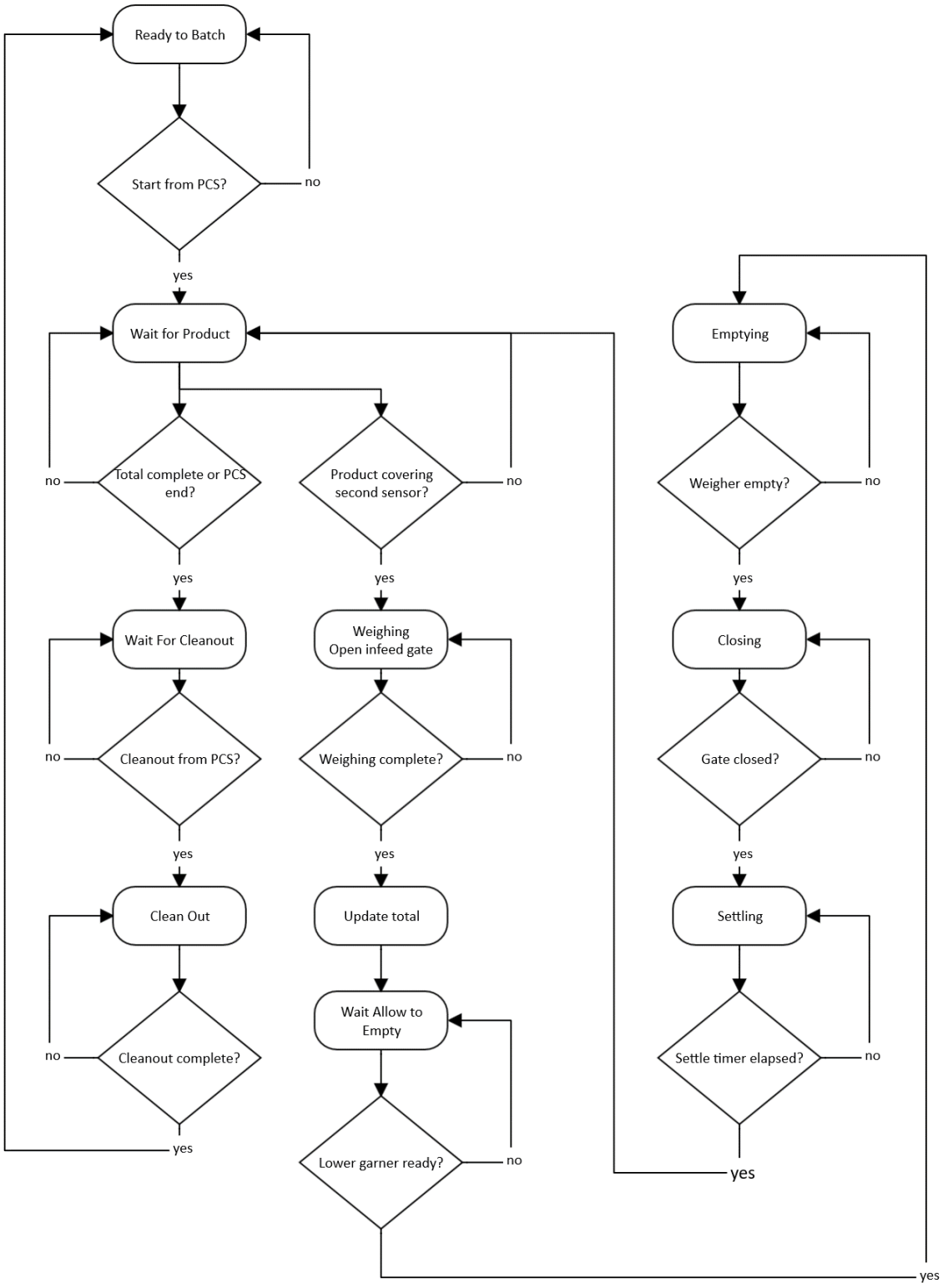


Allied Grain Systems Model CA1000-60K Weighing Instrument – System Overview

FIGURE 6/14B/22 – 3

B&R Model X20PC1684 PLC

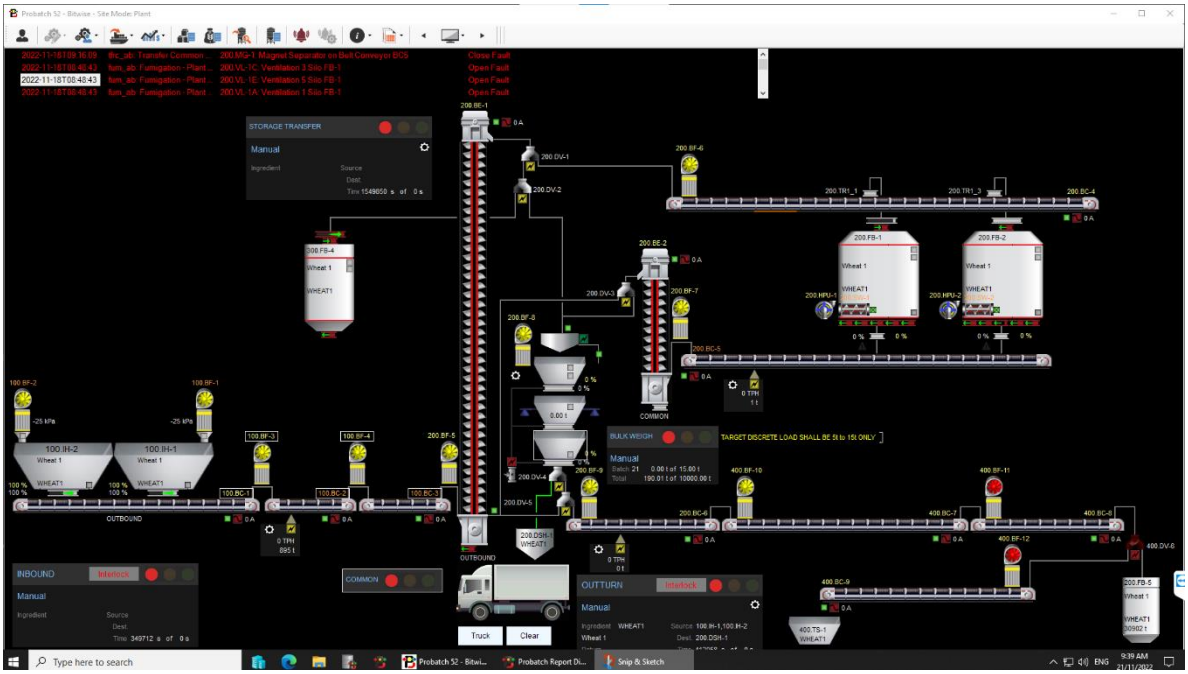
FIGURE 6/14B/31 – 4



Weighing Sequence Flowchart

Weighing Sequence Flowchart (Overview)

FIGURE 6/14B/31 – 5



Allied Grain Systems Plant Control System Operator Screens (Typical)

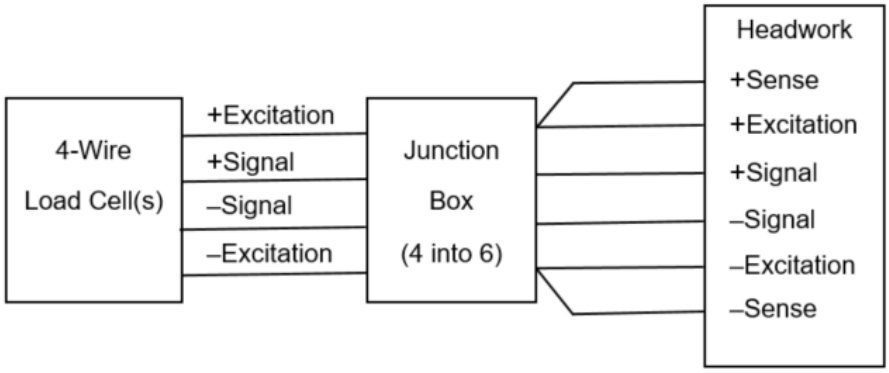
FIGURE 6/14B/31 – 6

Run ID	Batch	Code	Name	Req Amt (t)	Act Amt (t)	Tare (t)	Gross (t)	Start Weigh	Time to Weigh (s)	Time to Empty (s)
133	55	WHEAT1	Wheat 1	15.00	14.95	0.00	14.95	08/11/2022 15:18:24	16	13
133	56	WHEAT1	Wheat 1	15.00	15.22	0.00	15.22	08/11/2022 15:23:07	15	13
133	57	WHEAT1	Wheat 1	15.00	15.17	0.00	15.17	08/11/2022 15:24:45	15	62
133	58	WHEAT1	Wheat 1	15.00	14.55	0.00	14.55	08/11/2022 15:29:32	15	13
133	60	WHEAT1	Wheat 1	15.00	15.30	0.00	15.30	08/11/2022 15:37:54	15	73
133	61	WHEAT1	Wheat 1	15.00	15.07	0.00	15.07	08/11/2022 15:41:59	15	13
133	62	WHEAT1	Wheat 1	15.00	15.12	0.00	15.12	08/11/2022 15:43:05	15	95
133	63	WHEAT1	Wheat 1	15.00	14.69	0.00	14.69	08/11/2022 15:45:50	16	135
133	64	WHEAT1	Wheat 1	15.00	15.12	0.00	15.12	08/11/2022 15:55:39	15	13
133	65	WHEAT1	Wheat 1	15.00	15.20	0.00	15.20	08/11/2022 15:58:53	15	13
133	66	WHEAT1	Wheat 1	15.00	15.05	0.00	15.05	08/11/2022 15:59:59	15	94
133	67	WHEAT1	Wheat 1	15.00	14.60	0.00	14.60	08/11/2022 16:02:40	15	266
133	68	WHEAT1	Wheat 1	15.00	15.30	0.00	15.30	08/11/2022 16:13:54	15	921
133	69	WHEAT1	Wheat 1	15.00	15.10	0.00	15.10	08/11/2022 16:29:33	15	129
133	70	WHEAT1	Wheat 1	15.00	14.96	0.00	14.96	08/11/2022 16:32:00	15	189
133	71	WHEAT1	Wheat 1	15.00	14.71	0.00	14.71	08/11/2022 16:35:27	16	152

Note: The cycle time shown in the report represents the time between values being recorded into the system database, due to possible network/computer delays it does not necessarily accurately reflect the time between the ‘gross’ and ‘tare’ readings

Typical Output/Printout

FIGURE 6/14B/31 - 7



4-Wire Analogue Load Cell Connection Using Junction Box

~ End of Document ~