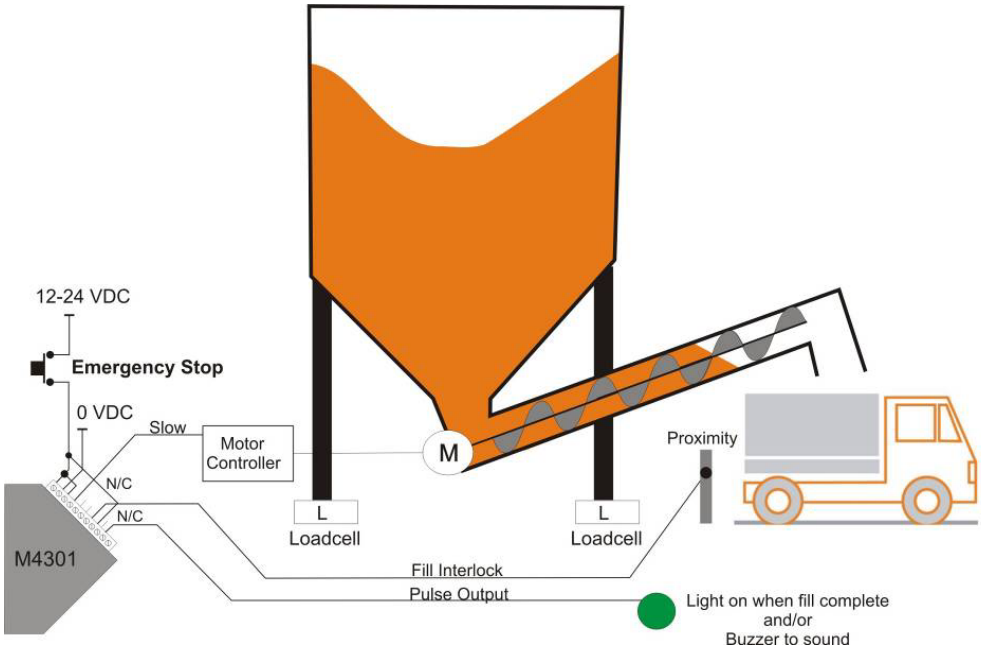
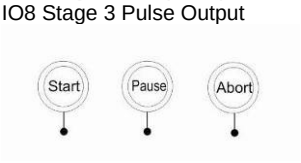
Application Note: R42x-K410 Negative Filling from a Silo into a Truck

Application:



IO1 All Stages Batch Interlock
IO2 Stage 1 Slow Fill
IO3 Stage 1 Medium Fill
IO4 Stage 1 Fast Fill
IO5 Stage 1 Fill Interlock
IO6 Stage 2 Dump Enable
IO7 Stage 2 Dump Output
IO8 Stage 3 Pulse Output



Various size trucks are to be filled from a silo. The material flow is controlled using a screw feed that could use one or up to three (3) speed controller. The K410 has three (3) set stages a FILL, followed by a DUMP then a FINISH. The FILL stage is used to FILL the truck using a weigh-out setting. The DUMP stage is not used in this scenario. The FINISH stage pulses an output to drive a buzzer or light as required. The inputs and outputs on the K410 are set according to the table above.

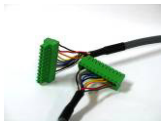
- The three indicator function keys default to F1 Start, F2 Pause and F3 Abort.
- Emergency Stop: An emergency stop is connected to the batch interlock (IO1). Should the batch interlock be removed the batch process will halt. When used the emergency stop in the example cuts power to the IO module - shutting down the power to all outputs. By wiring it into the interlock the software can pause to coincide. When the emergency stop is released, the operator can restart the batch with the Start key to safely resume batching.
- The K410 features up to 100 recipes, allowing varying truck loads to be supported in this example.
- A Fill Interlock (IO5) is used on a proximity sensor and must be active for the duration of the fill to indicate the truck is in place and ready for filling.
- Auto-inflight correction is used to ensure filling accuracy is maintained
- The Dump Enable (IO6) and Dump Output (IO7) are not used in this scenario. Dump-to-time is used to effectively skip this stage. Note the dump enable (IO6) must be shorted to COM+ of the module.
- The FINISH stage is a pulse on IO8 that drives either a light or buzzer to indicator to the driver that the fill is complete and to move on. The duration can be set via the operator interface.

Components:

R420-K410-A
R42x Filling Indicator VDC

M4301
8 I/O Module

M4901
8 voltage free relay outputs rated to 250VAC 8A



M4902
Cable, M4901 to Module

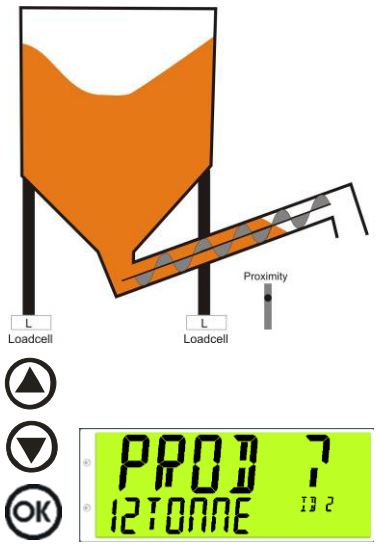
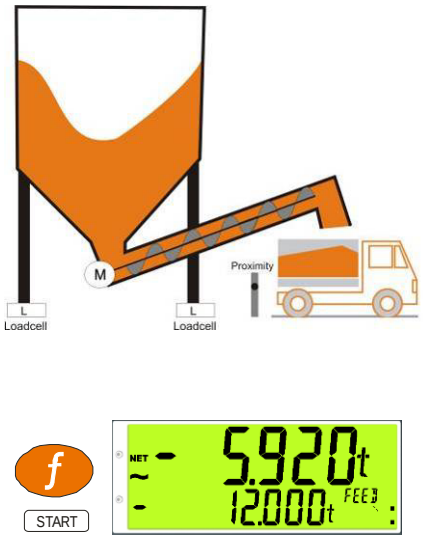
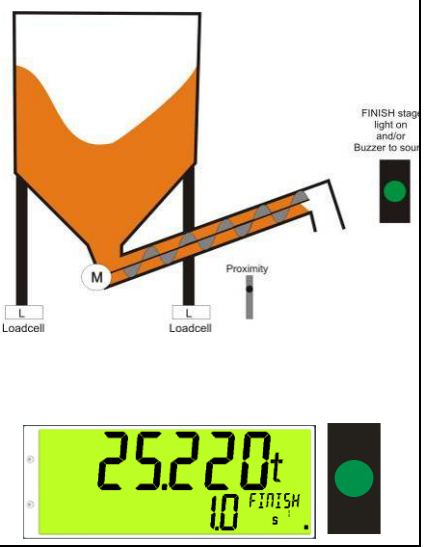
A10010
Power Supply, 12VDC, 2A DIN Rail

*Note1 Either R420s ABS or R423s flush stainless steel housing could be used.
*Note2 Suitable external power supply required for M4301 and M4901

Operation:

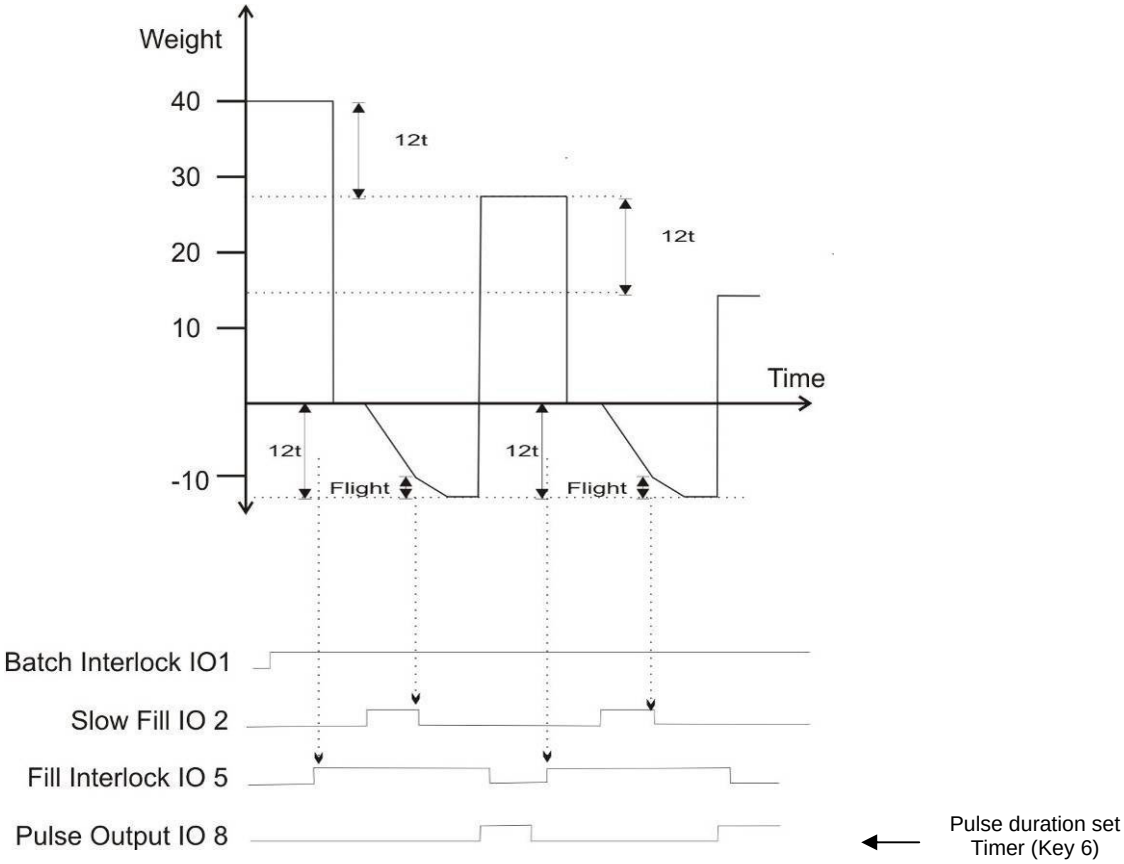
Set Up Site Commissioning

Enter recipes with positive weight targets for each truck load size and name.	
Adjust flight setting as required using the Flight (8 key) – in-flight and preliminary targets FLIGHT is the expected weight of material in flight and is initially set by the operator; auto in-flight can then make fine adjustments. It applies to the slow fill output. (Note M.PRE and F.PRE should be set to larger than target as they are not in use)	
Set pulse duration of Finish stage as required using the Timer (6 key). In this example the pulse drives a buzzer or light, so the time sets how long the sound or light is on for. (Note that the default duration is 0s and if no duration is set the Finish stage is effectively skipped.)	

Select Recipe	Stage 1 – Fill to Target	Stage 3 – Finish (Pulse)
		
The truck operator selects the Recipe/Product that defines the load that is required. In this example three recipes have been defined 8TONNE, 10TONNE and 12TONNE. It is selected using the Up/Down arrows and OK to select	Stage 1 FILL commences with the operator pressing the Start key. **The Fill Interlock (I/O 5) must be active for the duration of the fill indicating the truck is in place.**	The FINISH stage is a Pulse Output IO8. The pulse output could drive a buzzer or a light to alert the operator that the fill is complete and to move on. It lasts for the duration set via the Timer. After the Finish stage the unit returns to idle.
		

Delays: For each of the three stages it is possible to define a delay either at the start (DLY.ST) or the end (DLY.END) of the stage, of up to 5 hours.

Timing Diagram



The instrument has three (3) stages, FILL, DUMP and PULSE. These stages have fixed inputs and outputs, unused interlock or enable inputs should be shorted to the
COM+ of the module. The table below shows the fixed IO used in the batch.

IO	Stage	Use
IO1	All Stages	Batch Interlock
IO2	Stage 1	Slow Fill
IO3	Stage 1	Medium Fill
IO4	Stage 1	Fast Fill
IO5	Stage 1	Fill Interlock
IO6	Stage 2	Dump Enable
IO7	Stage 2	Dump Output
IO8	Stage 3	Pulse Output

Indicator Configuration:

```
BATCH
  GEN
    Z.START   : NO
    Z.ILOCK   : NO
    AUTO.ST   : SINGLE
    USE.PT    : NO
    FLT.AV    : 5
    F.DISP    : END
    JOG.TGT   : TARGET
    ABT.ACT   : TOTAL
    ERROR     : PAUSE
    TOL       : NONE
    PRT.OUT   : PRINT.1
  MAT
    NAME 1    : FEED
```

In-flight averaging (FLT.AV): The number of in-flight results to be averaged. If it is greater than five (5) then extreme results are ignored. This averaged in-flight result is used with auto jog and auto flight FILL correction.

Stage 1: FILL In-flight setting

The slow fill is switched OFF when the weight left to fill equals the in-flight. The in-flight can be set manually or automatically adjusted using past fill results.

Auto Flight (AUT.FLT): Uses the average fill error to calculate a corrected in-flight. The amount of averaging is determined by FLT.AV. The operator can set a starting in-flight value.

Stage 2: Dump to TIME so as stage is effectively skipped as it isn't required in this scenario.

```
STAGES
  STAGE.1
    FEEDER    : MULTIPLE
    ST.ACT    : TARE
    CORR      : AUT.FLT
    DLY.ST    : 0.000 s
    DLY.CHK   : 0.000 s
    DLY.END   : 0.000 s
    SCP.FLT   : PROD
    SCP.TOL   : GLOBAL
    DIRN      : W.OUT
  STAGE.2
    DMP.TYP   : TIME
    DLY.ST    : 0.000 s
    DLY.CHK   : 0.000 s
    DLY.END   : 0.000 s
    PLS.TME   : 1.000 s
  STAGE.3
    NAME      : FINISH
    DLY.ST    : 0.000 s
    DLY.END   : 0.000 s
    SCP.PLS   : GLOBAL
ANL.OUT
End
```

```
SAFE SETUP
  GEN.OPT
  H.WARE
  SCALE
  FUNC
    NUM       : _3_
    SF1
      TYPE    : START
      KEY     : F1
    SF2
      TYPE    : PAUSE
      KEY     : F2
    SF3
      TYPE    : ABORT
      KEY     : F3
```

For more information refer to the Reference Manual for this product