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Operation Manual

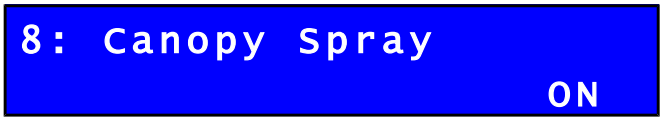
PMC-R Shield Control System

Note also that the last value on the bottom line is invalid causing it to be displayed as "~~~".

Master Display

When an operator uses the PMC-R on one shield to control another shield manually, the shield where the operator is pressing keys is called the Master and the Master Display will be shown. Although most hydraulic functions can be activated using the dark blue "man-in-place function keys" there may be other hydraulic functions available. These are called Auxiliary Functions and are shown in the display where they are controlled using the N & P arrow keys.

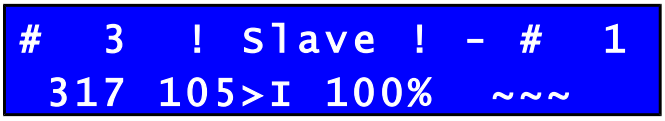
For example, the Canopy Spray line allows the operator to control the canopy spray function by pressing and holding the P-key (the arrow below the "ON" text).



From the Master Display, available Auxiliary Functions are accessed by using the Menu Navigation keys to scroll up or down.

Slave Display

The Slave Display is shown on a shield that has been selected from another shield.

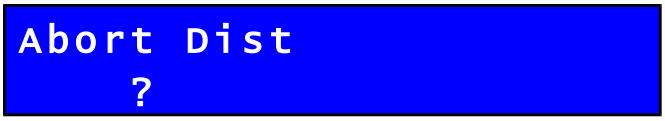


The top line indicates that the shield is being operated as a slave unit. It shows that this is shield #3 and it is being controlled by shield #1.

The bottom line continues to show the default display of sensor values and shearer position.

Input Display

When an operator is entering a numerical value the display is in Input Mode and will show the name of the value being entered and a question mark, similar to this:



Input Mode terminates when the Enter key is pressed or, if no keys are pressed, after a several second timeout.

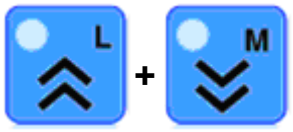
some other line

... pressing the Menu Left key moves the display to : Leg Lower :. Pressing it again moves the display to :Autosequence:. If it is pressed again, the display moves to the default display.

From the default display, the Menu Right key begins the process of navigating the menu structure and the Menu Left key restores the previously timed-out display (see the Go Back Feature below).

Freeze Display Feature

If the Menu Up and Menu Down keys are pressed at the same time, the display will be frozen – it won't revert to the default display when Key-time expires. To use this, the operator must scroll to the desired line and hold the last key (Menu Up or Down) and then press the other one.



freezes the display!

Go-Back Feature

Pressing the Menu Left K-key after Key-time expires and the display reverts to the default display makes the display "Go Back" to the line that was previously displayed. This only affects the display; it does not restore the previous action. For example, when the timeout happens midway through a three keystroke process, the Go Back feature will restore the display line but the keystroke process must be entered again from the beginning. Or, if the timeout happens while in Master Mode (operating a Slave shield), the Go Back feature will not re-select the Slave shield.

If there is no valid "previous line", then the Go Back key is not valid.

K-key goes back to previously shown display

Start Options

ASQs can be started manually, by Batch Advance, or by SRB.

ASQs are not allowed if…

… the network is broken
… the shield is locked
… a neighbor shield is Locked
… the shield has a Solenoid Driver error
… the shield is within an Umbrella Lock or Maintenance Lock

If the ASQ is allowed, Last Automatic Function text will be posted as “Manual ASQ”, “Batch ASQ”, or “SRB ASQ”.

Prewarning / Active Display

The ASQ active display is immediately activated. It will retain the default line2 (showing sensors values, etc) while line1 will show “! ASQ ! ” followed by the “ASQ Step” - 14 characters max. that indicate the primary action at the moment.

Restrictions

The standard restrictions apply, except for the Umbrella Lock and Key-time restrictions, which are handled differently within the ASQ operating logic.

In addition, ASQs cannot be started and will be aborted if the in-shield **parameter "ASQ Status"** is not Enabled.

Parameter “ASQ Status”

If the ASQ cannot start because a neighbor shield is locked, an error is posted **(err: "ASQ ERROR adj shield locked").**

If the ASQ is aborted due to the standard restrictions, an error is posted **(err: "ASQ ERROR aborted").**

If the ASQ start command is received while Key-time is active, the ASQ will wait up to 10s for Key-time to expire. If it does, the ASQ proceeds normally; if not, the ASQ stops and posts an error **(err: "ASQ ERROR operator on shield").**

Umbrella Lock interaction

The ASQ will be paused if an Umbrella Lock occurs during the ASQ or the ASQ occurs during the Umbrella Lock. In the first case, the ASQ will immediately go to the Final Set Step, and then to the Umbrella Lock Pause step. In the latter case, the ASQ will begin with the Umbrella Lock Pause step.

Detailed Operating Logic

There are various steps which are adjustable and selectable to provide the operator with very flexible control of the Autosequence. The chart on the next page shows the relationship between the steps. Details for each step follow the chart.

Errors

ASQ ERROR main hyd pressure low

ASQ paused because the main hydraulic pressure was too low.

ASQ ERROR paused – umbrella lock

Umbrella Lock caused ASQ to pause; will resume if umbrella removed soon enough.

ASQ ERROR abort – umbrella lock

ASQ aborted because Umbrella Lock remained more than 90s.

ASQ ERROR aborted

ASQ aborted by Quickstop, Lockout, Stop key, etc.

ASQ ERROR shld already advanced

ASQ did not begin because this shield appears to be advanced (see parameter Advancing Tgt Stroke).

ASQ ERROR neighbor shld not adv

ASQ aborted because transition shield didn't advance within 60s.

ASQ ERROR adj pressure too low

Adjacent shield leg pressure too low. At least one neighbor shield must have at least one leg pressure reading of 100 bar or more.

ASQ ERROR adv press not reached

Legs did not lower enough for adv to begin; see parameters Advancing Pressure and Initial Lowering Time.

ASQ ERROR slow advance

Shield advancing too slowly.

ASQ ERROR 1st advance timeout

Shield not fully advanced before parameter Advancing Time expired.

ASQ ERROR advance failed

The shield failed to advance; check Retry Count, Relowering Time, Readvance Time.

ASQ ERROR set press not reached

Legs did not reach Final Set Pressure within Final Set Time

ASQ ERROR adj shield locked

Black lockout button is pressed on adjacent shield.

ASQ ERROR network

ASQ aborted because of broken net.

ASQ ERROR no ram sensor

ASQ was trying to wedge advance but didn't have a usable ram sensor reading.

ASQ ERROR operator on shield

ASQ aborted because an operator was on the shield pressing keys.

ASQ ERROR leg pressure invalid

One or both legs are invalid. Replace or turn off sensor.

Prewarning / Active Display

When the pullback direction is selected (via the Group Select Left or Right key) the selected shields will prewarn and display the Conveyor Pullback display. The display will retain the default line2 (showing sensors values, etc) while line1 will show **"! CPULL! "** followed by text that indicates the current action.

Operating Logic

After the direction is selected and the Start key is pressed (or the Pull Back key is held), the prewarning sounds and the CPull-active display is shown.

The Batch Pullback logic will ensure that no shields in the selected group will be delayed by current reservation (i.e., each shield will pre-reserve enough current to activate the pullback valve) and waits until at least 3s of prewarning time has passed.

If 10 seconds passes without being able to pre-reserve current, the pullback will terminate and the operator's shield will post an error **(err: "PULLBACK ERROR current reservation")**.

The shields are then triggered consecutively, based on the direction indicator. The delay between triggering shields is set by **parameter "Delay Time"** under Configuration->Conveyor Pullback.

Parameter "Delay Time"

When the pullback function is triggered, the prewarning sound is muted but remains active as long as the pullback function is active.

If the manual mode is being used, when the operator releases the Pull Back key, the pullback action will stop.

Parameter "Tgt Stroke" sets the target stroke for the pullback. The conveyor will be pulled to this stroke value except at the ends of the group where the Conveyor Pullback protection logic will taper the pullback to avoid overstressing the conveyor and ram connections.

Parameter "Tgt Stroke"

Conveyor Pullback Protection

The Conveyor Pullback delta protection allows the shield to only pullback 10% more than the neighbor shields.

Example: 20 shields are selected to the left to do a pullback. The target stroke was set to 50%. The shield at the far end could pull back only to 90% because the next shield is outside of the pullback area. The next shield in the pullback area can pull to 80%, the next to 70%, etc. The same would happen on the end nearest to the operator. This could mean that only certain shields in the middle of the group would reach their target stroke of 50%.

Delta protection

10% difference in strokes allowed

When delta protection stops the pullback, it is only temporary; the pullback logic is still triggered but the hydraulic function is deactivated and the pullback status display changes to "< delta" or "delta >" depending upon which neighbor shield triggered the delta protection. As soon as the ram stroke difference falls to 5%, the pullback resumes. Delta protection does not suspend the Conveyor Pullback Timeout feature.

Parameters "Headgate Push Ctl" and **"Tailgate Push Ctl"** (both under Configuration->Conveyor Push) define which shield is the controlling shield at each end of the face.

If set to 5, then the first 4 shields will not push until the 5th one is ready to push.

Parameters
"Headgate Push Ctl"
"Tailgate Push Ctl"

Parameters "Headgate Push Group" and **"Tailgate Push Group"** define the number of shields at each endgate that will be controlled by this feature.

If **"Headgate Push Ctl"** is 5, all shields that are in the **Headgate Push Group** cannot push more than 10% greater than the controlling shield, which is number 5. If one of these shields has a sensor that is invalid or turned Off, that shield just pushes for time. This would work the same for the tailgate end of the face but with respect to the **Tailgate Push Group.**

Parameters
"Headgate Push Group"
"Tailgate Push Group"

If the controlling shield or the adjacent shield (on the mid-face side) has a ram sensor that is invalid or turned Off, the controlling shield will be shifted towards mid face until an acceptable controlling shield is found. Once the controlling shield has shifted, it does not shift back until power cycles or the **Headgate Push Ctl** is changed.

When this feature has paused the push action, the Conveyor Push action text on the top line will show "gateend –".

Triggering Method Affects Operation

Which safety and control methods are used depends upon how the conveyor push was triggered.

Trigger	Push Mode	Notes
In-shield Locking Push key Adjacent Locking Push key	Manual	Applies: Conveyor Push Timeout Target Stroke Timeout Target stk (optional) Does not apply: Shield back protection Delta protection
SRB BankPush Endgate Push	Automatic	Applies: Shield back protection Delta protection Endgate even-push Timeout Target Stroke

Enable / Disable Options

Parameter “H->T Watercurtain” must be set to “On” for the watercurtain sprays to work when mining from Head to Tail. Parameter “T->H Watercurtain” must be set to “On” for the watercurtain sprays to work when mining from Tail to Head.

Parameters
"H->T Watercurtain"
"T->H Watercurtain"

The Water Curtain feature is always available on all shields. However, the local parameter Curtain Spray Function can be used to prevent the spray from activating on any specific shield.

Parameter
"Curtain Spray Function"

Restrictions

The Water Curtain Feature is subject to the standard Automatic Function restrictions.

Errors

There are no Watercurtain errors.

Parameter Summary

H->T Water Curtain **On, Off**
Enable or disable water curtain on head to tail pass.

T->H Water Curtain **On, Off**
Enable or disable water curtain on tail to head pass.

H->T Lead Offset **0-50**
For H->T pass, Zone 1 begins this far ahead of the shearer position.

H->T Zone 1 Size **0-50**
For H->T pass, Zone 1 covers this many shields starting at the shield that is Lead Offset ahead of the shearer position.

H->T Zone 2 Size **0-50**
For H->T pass, Zone 2 covers this many shields starting at the shield that is Lead Offset ahead of the shearer position.

H->T Zone 3 Size **0-50**
For H->T pass, Zone 3 covers this many shields starting at the shield that is Lead Offset ahead of the shearer position.

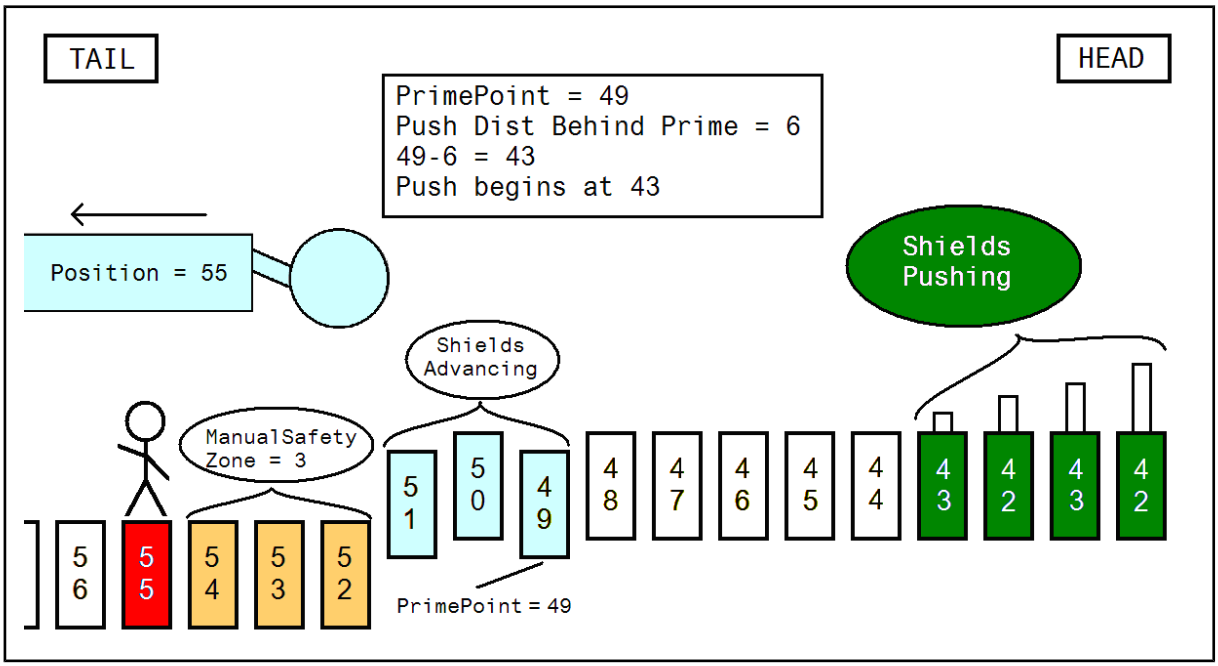
H->T Zone 4 Size **0-50**
For H->T pass, Zone 4 covers this many shields starting at the shield that is Lead Offset ahead of the shearer position.

H->T Zone 5 Size **0-50**
For H->T pass, Zone 5 covers this many shields starting at the shield that is Lead Offset ahead of the shearer position.

H->T Zone 1 Spray Opt **None, Front, Rear, Both**
For H->T pass, enable or disable sprays in Zone 1.

H->T Zone 2 Spray Opt **None, Front, Rear, Both**
For H->T pass, enable or disable sprays in Zone 2.

The picture below gives an example of setting the “Push Dist Behind Prime” to 6 while in the manual tracking mode of SRB. This would cover shields 48 through 44 in the drawing, with 43 being the shield closest to the shearer that is pushing.



Delayed or Reverse Pushing

Sometimes there is a need to delay or push in the opposite direction from normal. This could be for conveyor loading issues or maybe to cause the conveyor and shields to eventually move from the Tailgate toward the Headgate or Headgate to Tailgate. There are parameters that will allow the operator to do either of these. To delay the push when going H>T, set the H>T Push Trig Shld to a higher number. If, for example, it is set to 150, then the push will not be triggered until the position gets to 150 and the Primepoint is caught up to this point. To delay the push when going T>H, set the T>H Push Trig Shld to a lower number so it doesn't start until the shearer position is closer to the HG.

To push in the opposite direction from normal which makes the conveyor move towards the opposite end, enable the reverse push in the desired mining direction by setting either H>T Push Reverse or T>H Push Reverse to ON. The delay point must be set to a location farther down the face. If the delay point is not far enough away there will be no reverse effect. When the shearer is traveling toward the Push Trig Shld, the normal conveyor push which follows behind the shearer does not occur. Once the shearer passes the Push Trig Shld and that shield is far enough behind the shearer that it would normally push then a push is started from that point and moving away from the shearer which is the opposite direction of the normal push. The other shields past the Push Trig Shld will push at the normal time and in the normal direction.

TG Dblcut Pt from TG **10-40**

Number of shields from the TG that marks the point the shearer must come to on TG double cut.

TG Readvance Group **0-15**

How many TG shields will readvance after the TG push.

Max # of ASQs **3-30**

Limit on number of ASQs that SRB will trigger behind the shearer.

Ram Refill @ Shearer **On, Off**

Option to activate conveyor push around the shearer.

FILTER STATION

The filter station control is a PMC-R SCU that controls the filter station solenoids and monitors the filter station sensors. This SCU is located in the face network, between the Server and #1 shield.

Based on the pressure difference between the pressure entering a filter bank and exiting a filter bank, the filter station can automatically initiate a “backflush sequence” in which the filters are backflushed to reduce the pressure loss.

Operator Display & Keystrokes

(status), as shown in the display examples, will be one of the values below:

IDLE: Filter station is idle.

EMULSION BFLUSH: High-pressure filter backflush is active.

QUICKSTOP #nnn: Quickstop is pressed on the indicated PMC-R (no backflush action is possible).

LOCKED: Lockout button is pressed on filter station.

No Solenoid Drvr: Filter station has no solenoid driver.

Network! SRV- 6: Network is broken where indicated.

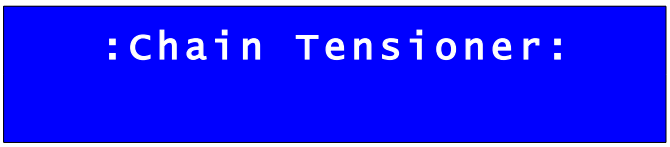
The filter station has two default displays. Pressing the P-key will toggle between them.

The first default display shows the filter station status and the incoming and outgoing emulsion pressure for each pair of emulsion sensors. In this example, the incoming pressure and outgoing pressure is 295 bar and 285 bar for the first sensor pair, and 293 bar and 280 bar for the second sensor pair.

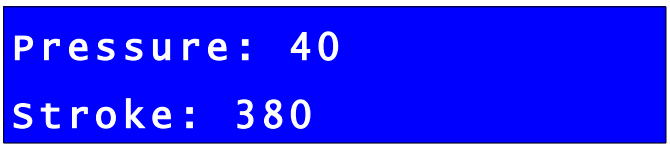
Mode:

State:

Reason for Shutdown



Menu heading. Scroll to the right to go into the Menu.



This menu gives the pressure value and the stroke value of the tailgate chain tensioner. Press the C-key twice for a quick way to go to this menu.

This menu gives the mode and state of the tailgate chaintensioner: Auto Active states that the program is in auto and is running. State: Waiting 4 active says it is waiting for a startup command.

This menu will show the reason for the chaintensioner shutting down.

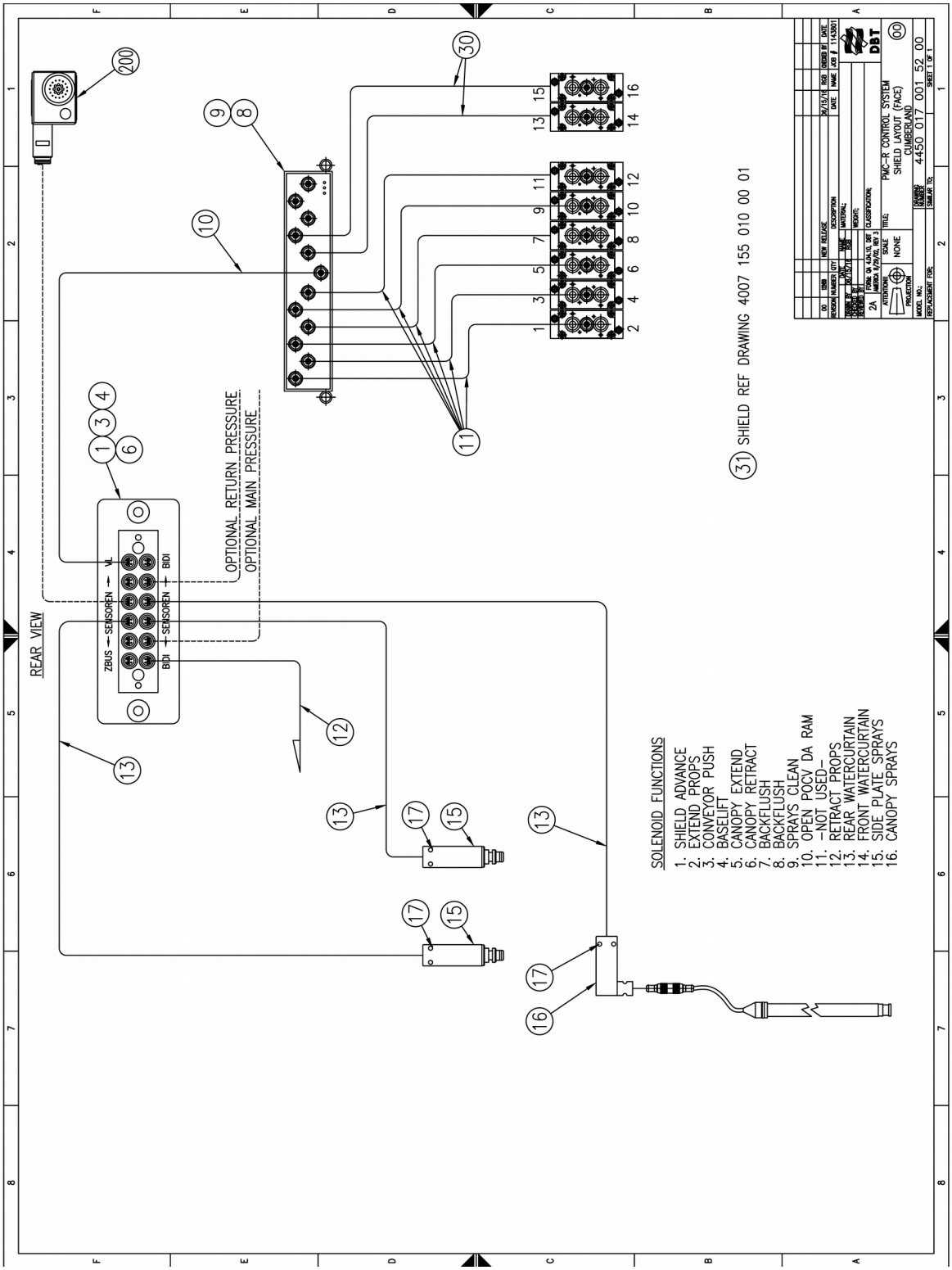
Chain Tensioner Stroke Warning Limit

This feature allows the operator to set a value that when reached it rings out on the face to let the operators know the tensioner stroke is getting close to shutting the face conveyor down due to reaching the maximum stroke value.

TG Stroke Warn Limit is the value that when reached by the tailgate cylinder stroke it will ringout the face letting the operator know they are getting close to the max stroke value set in the chain tensioner parameters that will shut down the chain tensioner PMC-R. It is recommeded to set this parameter below the max stroke parameter in the tailgate chain tensioner PMC-R parameters.

CONFIGURATION DRAWINGS

Shield Layout (Face)



<< Different Pgm!

This PMC-R has a diff program than the neighbor PMC-s over there<<<

<< Diff. Params! >>

This PMC-R has different global parameters than both neighbor PMC-Rs. This should correct itself within 1 minute.

Diff. Params! >>

This PMC-R has different global parameters than PMC over there >>>. This should correct itself within 1 minute.

<< Diff. Params!

This PMC-R has different global parameters than PMC over there <<<. This should correct itself within 1 minute.

Diff Params from #142

This PMC-R has different global parameters than the PMC-R indicated.

~~~ No Net Number

SCU has no netnumber. Fix connection between this location and server or number manually by pressing the #-key end Enter and then entering the correct shield number.

#123 Shield Type Error

Shield type parameter and coding plug (B2 port) do not match. Shield is not operable because the program does not know what type of shield this is.

ERROR - SDM Appl.

Solenoid driver has wrong program internally. Driver must be reprogrammed.

ERROR - SDM Loader

Solenoid driver has wrong program internally. Driver must be reprogrammed.

ERROR - Display Appl.

SCU display board has wrong program internally. Display board must be reprogrammed - replace PMC-R.

ERROR - Display Loader

SCU display board has wrong program internally. Display board must be reprogrammed - replace PMC-R.

ERROR - Wrong System!!

Wrong firmware program! Load new firmware or replace PMC-R.

ERROR - Wrong Booter!!

•••HG Seq Last Shield	Range: 1-15	Def: 5

See description above.

•••TG Seq First Shield	Range: 1-15	Def: 3

Shields between TG Seq First Shield and TG Seq Last Shield pull sequentially, beginning with TG Seq First Shield. This allows gate shields and transition shields to be advanced in correct order. Both values are measured as the number of shields from th

•••TG Seq Last Shield	Range: 1-15	Def: 5

See description above.

•:SRB Face Automation:

Section for SRB parameters. SRB is face automation that advances and pushes shields automatically based on shearer position.

••Serial Tracking

Track shearer based on data provided from shearer. Can only be switched from Off to On. To switch Off, toggle another tracking mode to On.

••Infrared Tracking

Track shearer based on IR transmitter mounted on shearer. Can only be switched from Off to On. To switch Off, toggle another tracking mode to On.

••Serial Tracking Type

Use this parameter to switch between CAT and Joy shearer type communication to the PLC. PMCP = CAT. PLC = Joy

••Beginning Shield	Range: 1-30	Def: 10

First shield on face that SRB will control.

••Ending Shield from TG	Range: 1-30	Def: 10

# of shields from TG that marks last shield that SRB will include. (1 means last shield; 2 means next to last shield, etc.)

••Cycle	Options: BIDI , UNIDI	Def: BIDI

Toggle between UniDi or Bidi SRB cycle. Bidi expects double cuts at each end; UniDi expects no double cut at either end.

••:H->T Options:

Parameters for head-to-tail pass.

Section for Network configuration parameters.

•••Server Connected	**Options: NO, YES**	**Def: YES**

Toggle option for a PMC-R server connection. If set ton ON, the server should have a 10k coding plug. If set to OFF, shield #1 must have a 10k coding plug in order to number shields.

•••Face Direction	**Options: LEFT, RIGHT**	**Def: RIGHT**

Toggle face direction. This will be set automatically if there is a server.

•••Number of Shields	**Range: 1-310**	**Def: 186**

Set # of shields on face.

•••Shield Group 1 Type	**Options: Face Shield, SS Shield**	**Def: Face Shield**

Toggle shield type for 1st shield group.

•••Shield Group 2 Type	**Options: Face Shield, SS Shield**	**Def: Face Shield**

Toggle shield type for 2nd shield group.

•••Shield Group 3 Type	**Options: Face Shield, SS Shield**	**Def: Face Shield**

Toggle shield type for 3rd shield group.

•••Shield Group 4 Type	**Options: Face Shield, SS Shield**	**Def: Face Shield**

Toggle shield type for 4th shield group.

•••Shield Group 5 Type	**Options: Face Shield, SS Shield**	**Def: Face Shield**

Toggle shield type for 5th shield group.

•••Shield Group 6 Type	**Options: Face Shield, SS Shield**	**Def: Face Shield**

Toggle shield type for 6th shield group.

•••Shield Group 2 Begin	**Range: 2-310**	**Def: 310**

Beginning shield # of the 2nd shield group on the face.

•••Shield Group 3 Begin	**Range: 3-310**	**Def: 310**

Beginning shield # of the 3rd shield group on the face.