M2S Automation User Guide

Changelog

Rev	Author	Changes
1	Erdem Keskin	first revision
2	Erdem Keskin	operation subheading added

Table of Contents

1. Definitions

1.0 Modes

1.0.0 No Mode

That is a default mode for all sections. When PLC powered up, or a new program downloaded to PLC, all sections will have this mode selected. The operator should change to the appropriate mode after that. After switching out of that mode, you will not be able to return this mode.

1.0.1 Operator Mode

That is a semi-manual/manual mode for all sections. In this mode, the operator will have buttons to do manual operations. That includes jog buttons for all the pieces of equipment, also includes moving to predefined positions of that equipment. So the Operator doesn't need to approximate where the equipment should be in to start working.

1.0.2 Program Mode

This is a buffer mode between Operator Mode and Program Start. When Operator needs to stop automation gracefully, the section will set to this mode. In this mode, sequencers will keep their state, and they won't allow operators to change their states. The operators can anytime return to Program Start or Operator Mode from this mode.

1.0.3 Program Start

That is an automatic mode for all sections. In this mode, the M2S will operate automatically. All sequencers will react to either incoming new glass from Manz or unloading a new motherboard from the crate. The sequencers will keep their states and continue to run except any mode changes or any expected operator input. In the case of ordinary operation, most of the actions from the Operator still will be in this mode. I.e. when the barcode reader failed to scan on the conveyor, the Operator needs to manually enter the barcode while the section is still in Program Start.

1.1 Functions

The M2S consists of 2 functions defined as `Loading` and `Unloading`.

1.1.1 Loading

In this function, the M2S will pick up a motherboard from Manz and place it on the Crate.

1.1.2 Unloading

In this function, M2S will send back the motherboards it loaded to crate while in Loading Mode

2. General Information

This line consists of 3 sections and 10 sequencers for a given function (Loading or Unloading). They all independent in regards to the part they control, but to provide expected behavior of the M2S they will work together in an interlocked manner. The three sections of the M2S can be independently switched to Operator or Program modes. But when expect input from each other, both parties should be on **Program Mode** and **Program Start** states. This same principle also applies to sequencers. They will not progress if one of the sequencers they rely on is not in **Program Mode**.

2.1 Sections

The M2S is separated into 3 sections. Sections are mostly independent of each other, but for the line to operate fully automatically, they will need to be on Program Start. All sections have their independent Safety Zones. Any safety issue in one of the sections won't affect the other two.

2.1.1 Section 1

Section 1 contains the equipment in the *North Clean Room*. More information can be found in the Equipments section of this document. Section 1 must be on Program Start to pick up the glass from Manz robot with the EQ2EQ interface.

1. M110
2. M120
3. M130
4. M140
5. M150

2.1.2 Section 2

Section 2 contains the equipment in the *M2S Robot Cell*.
More information can be found in the Equipments section of this document.

1. M150
2. M160
3. M170
4. M180
5. M190
6. M200
7. Scrap Rack

2.1.3 Section 3

Section 3 contains the equipment in the *M2S Crate Loading Cell*
More information can be found in the Equipments section of this document.

1. M180
2. M210
3. M220
4. M230

2.2 Equipments

2.2.1 M110

That is the first conveyor of the line, and consist of 2 separate axes. Both of the axes are controlled by ES_M110L or ES_M110U sequencers decided by the currently selected function of the line.

2.2.1.1 M110 Lift

M110 Lift is the hardware side of the Manz transfer process.

2.2.1.1.1 Program Mode Loading

Loading sequence of M110 Lift is defined as follows:

1. Waits on wait position until Manz requests a transfer
2. Goes up the Manz position to pick up the motherboard
3. Waits for Manz to signal transfer complete
4. Moves up to M120 conveyor position to transfer the motherboard
5. After transfer complete, goes back to the waiting position for a new cycle

2.2.1.1.2 Program Mode Unloading

Unloading sequence of M110 Lift is defined as follows:

1. Waits on wait position until M120 sends a request to send
2. Goes up the M120 to pick up the motherboard
3. Waits for Manz to signal it is ready to pickup
4. Moves down to Manz position to transfer the motherboard
5. After transfer complete, goes back to the waiting position for a new cycle

2.2.1.1.3 Operator Mode Actions

1. Jog Forward
2. Jog Reverse
3. Move to Wait Position
4. Move to Manz Position
5. Move to M120 Position

2.2.1.2 M110 Conveyor

M110 Conveyor is responsible for transferring the motherboard to/from M120 to Manz's side so Manz robot can pick it up.

2.2.1.2.1 Program Mode Loading

Loading sequence of M110 Lift is defined as follows:

1. Waits until the lift is on M120 Position
2. Transfers the motherboard to M120, waits for a new cycle

2.2.1.2.2 Program Mode Unloading

In this mode, the conveyor will try to fix any position errors, so the transfer position with the Manz always will be the same.

Unloading sequence of M110 Lift is defined as follows:

1. Waits until the lift is on M120 Position
2. Transfers the motherboard from M120,
3. If there is any positioning error, it will try to fix it then waits for a new cycle

2.2.1.2.3 Operator Mode Actions

1. Jog Forward
2. Jog Reverse

2.2.2 M120

This conveyor consists of 2 separate axes. The Lift axis is not controlled by any of the sequencers. It is solely controlled by manually. The conveyor axis is controlled by ES_M120L or ES_M120U, depending on the selected function of the line.

2.2.2.1 M120 Conveyor

M120 Conveyor is responsible for transferring the motherboard to/from M130 to M110. In both functions, the conveyor will try to fix position errors while transferring the motherboard to themself.

2.2.2.1.1 Program Mode Loading

Loading sequence of M110 Lift is defined as follows:

1. Waits until there is a glass on M110 and it is on M120 conveyor position
2. Transfers the motherboard to M120
3. Will try to fix any position errors
4. Communicates with the M130 and waits until it is available
5. Transfers glass to M130 then waits for a new cycle

2.2.2.1.2 Program Mode Unloading

Unloading sequence of M110 Lift is defined as follows:

1. Waits until there is a glass on M130
2. Transfers the motherboard to M120
3. Will try to fix any positioning errors on the motherboard
4. Communicates with the M110, waits until it is available and Manz is ready to pickup
5. Transfers glass to M110 for sending to Manz then waits for a new cycle

2.2.2.1.3 Operator Mode Actions

1. Jog Forward
2. Jog Reverse
3. Jog Forward with M110
4. Jog Reverse with M110

2.2.2.2 M120 Lift

The Program doesn't control the lift axis of the M120 conveyor in any way. It is solely controlled by the Operator on HMI. Therefore It doesn't have any defined actions for loading and unloading modes.

2.2.2.2.1 Operator Mode Actions

1. Jog Forward
2. Jog Reverse
3. Move to Maintenance Position
4. Move to M130 Conveyor Position

2.2.3 M130

This conveyor consists of 1 axis and 2 pneumatic flaps. The axis and the flaps are controlled by ES_M130L or ES_M130U, depending on the selected function of the line.

2.2.3.1 M130 Conveyor

2.2.3.1.1 Program Mode Loading

Loading sequence of M110 Lift is defined as follows:

1. Waits until there is a glass on M120 and it is ready to transfer
2. Opens the West Flap for transfer
3. Transfers the motherboard to M130
4. Closes the West Flap after transfer completed
5. Will try to fix any position errors
6. Communicates with the M150 and waits until it is available
7. Opens the East Flap for transfer
8. Transfers glass to M150
9. Closes the East Flap after the transfer then waits for a new cycle

2.2.3.1.2 Program Mode Unloading

Unloading sequence of M110 Lift is defined as follows:

1. Waits until there is a glass on M150 and it is ready to transfer
2. Opens the East Flap for transfer
3. Transfers the motherboard to M130
4. Closes the East Flap after transfer completed
5. Will try to fix any position errors
6. Communicates with the M120 and waits until it is available
7. Opens the West Flap for transfer
8. Transfers glass to M120
9. Closes the West Flap after the transfer, waits for a new cycle

2.2.3.1.3 Operator Mode Actions

1. Jog Forward
2. Jog Reverse
3. Jog Forward with M120
4. Jog Reverse with M120
5. Open East Side Flap
6. Close East Side Flap
7. Open West Side Flap
8. Close West Side Flap

2.2.4 M140

2.2.5 M150

This conveyor consists of 2 separate axes, the Alignment system, and a Barcode Reader. The conveyor and lift axes are controlled by ES_M150L or ES_M150U, depending on the selected function of the line. And Alignment system is controlled by ES_M150Align regardless of the function of the line.

2.2.5.1 M150 Lift

M150 Lift is responsible for the transfer between conveyors and the robot. It has 3 predefined positions. 2 of them are used by sequencers in the normal cycle of the line.
The third one is just for maintenance and only will be used by the Operator in manual operation.

2.2.5.1.1 Program Mode Loading

Loading sequence of M150 Lift is defined as follows:

1. Waits on robot position until robot sends a clear to go conveyor position signal
2. Goes down to conveyor position
3. Waits for transfer of the motherboard from M130 to M150
4. Aligns the motherboard
5. Reads the barcode of the motherboard
6. Goes up to robot position
7. Waits for Robot to pick up the motherboard then wait for a new cycle

2.2.5.1.2 Program Mode Unloading

Unloading sequence of M150 Lift is defined as follows:

1. Waits until M160 transfers the motherboard to conveyor
2. Goes down to conveyor position
3. Waits for transfer of the motherboard from M150 to M130
4. Returns back to M160 transfer position then wait for a new cycle

2.2.5.1.3 Operator Mode Actions

1. Jog Forward
2. Jog Reverse
3. Move to the M160 position
4. Move to the M130 position
5. Move to the Maintenance position

2.2.5.2 M150 Conveyor

M150 Conveyor is responsible for transferring motherboard to/from M130 to M160.

2.2.5.2.1 Program Mode Loading

Loading sequence of M150 Conveyor is defined as follows:

1. Waits until there is a glass on M130 and M150 lift is on conveyor position
2. Transfers the motherboard to M150 from M130
3. Will try to fix any position errors, waits for a new cycle

2.2.5.2.2 Program Mode Unloading

Unloading sequence of M110 Lift is defined as follows:

1. Waits until M150 lift is on M130 conveyor position
2. Transfers the motherboard to M130, waits for a new cycle

2.2.5.2.3 Operator Mode Actions

1. Jog Forward
2. Jog Reverse
3. Jog Forward with M130
4. Jog Reverse with M130

2.2.5.3 M150 Alignment

M150 Alignment is responsible for squaring the motherboard before picking up by the robot and before transferring the motherboard to Manz. This process controlled by ES_M150Align sequencer.

2.2.5.3.1 Program Mode

The Sequence of M150 Alignment is defined as follows:

1. Waits for alignment request
2. First moves the conveyor to East direction to make sure the motherboard is aligned to East side of the alignment table
3. Raises the West blockers
4. Pushes motherboard from Eastside
5. Pushes motherboard from Northside
6. Lowers the West blockers
7. Waits for a new cycle

2.2.5.3.2 Operator Mode Actions

1. West Blockers Raise
2. West Blockers Lower
3. East Pushers Extend
4. East Pushers Retract
5. North Pushers Extend
6. North Pushers Retract
7. Alignment Request

2.2.6 M160

This equipment is the Robot. The Robot is controlled by CS_M160L or CS_M160U, depending on the selected function of the line. These sequencers also control the M2S itself. They will manage all of the other sequencers and the robot at a higher level. If Robot needs to interact with one of the additional pieces of equipment, CS_M160 will pass the control of the robot to that equipment. That sequencer will control the robot while in the process, then when the sequencer finishes, the equipment gives back the control of the Robot to CS_M160.

2.2.6.1 M160 Robot

2.2.6.1.1 Program Mode Loading

Loading sequence of M160 Robot is defined as follows:

1. Waits on the home position until there is motherboard to pick up on M150
2. Picks up the motherboard from M150 goes back to the home position
3. Depending on the status of the incoming motherboard, and response from Lisec
    1. If Lisec requests motherboard to be put on scrap
        1. Goes to Scrap Rack and places the motherboard
        2. Goes back home and waits for a new cycle
    2. If Manz requests motherboard to be put on scrap
        1. Goes to Scrap Rack and place the motherboard
        2. Goes back home and waits for a new cycle
    3. If Lisec requests motherboard to be put on M180
        1. Goes to M190 for Edge Detection Check
            1. If Edge detection is failed
                1. Puts motherboard to Scrap Rack
            2. If Edge Detection is a success
                1. Goes back to home with the motherboard
        2. Goes to M170 for plugging spacers
        3. After plugging in the spacers, the robot will go home
4. If spacers are plugged in correctly, the robot will load the motherboard to M180

2.2.6.1.2 Program Mode Unloading

Unloading sequence of M110 Lift is defined as follows:

1. Waits on the home position until sequencer says it to pick up a motherboard from M180
2. Picks up the motherboard from M180 goes back to the home position
3. Goes to M170 and unplugs the spacers and goes back to the home position
4. Places motherboard to M150 for alignment and barcode reading and goes back home position
5. If Lisec requests motherboard to be put on scrap
    1. The robot goes to M150 picks up the motherboard
    2. Goes to Scrap Rack and places the motherboard
    3. Goes back home and waits for a new cycle
6. If Lisec requests motherboard to be sent to Manz
    1. The robot goes to M150 picks up the motherboard
    2. Goes to M190 for Edge Detection Check
        1. If Edge detection is failed
            1. Puts motherboard to Scrap Rack
        2. If Edge detection is a success
            1. Goes to M150 to place motherboard there
    3. Goes back home and waits for a new cycle

2.2.6.1.3 Operator Mode Actions

1. Pickup from Scrap Rack
2. Pickup from M150
3. Put to Scrap Rack
4. Put to M150

2.2.7 M170

M170 consists of 2 sides, described as `West` and `East`. Both sides have an identical set of sensors and pneumatics. Each side is capable of 6 distinct pneumatic movements and has 12 sensors. This 6 movements defined as follows:

Test Grippers Extend and Retract

Gripper Lifts Extend and Retract

Gripper Extend and Retract

Swing Extend and Retract

Spacer Lift Extend and Retract

Pushout Extend and Retract

While `Spacer Lift Extend and Retract` and `Pushout Extend and Retract` moves responsible for supplying the spacers from Spacer Magazine to Spacer Application equipment, the rest of the 4 movements are used for spacer application itself.

2.2.7.1 M170 Spacer Application

Depending on the selected function of the line, this equipment is responsible for plugging or unplugging the spacers to/from the motherboard. Before this process is started, ES_M170L or ES_M170U sequencers will take control of the robot and stay in sync with the robot throughout the whole process. And return the control of the robot to CS_M160L/CS_M160U after finished with the Spacer application.

2.2.7.1.1 Program Mode Loading

Loading sequence of M170 Spacer Application is defined as follows:

1. Picks up new Spacer from Spacer Magazine using `Gripper Lifts` and `Gripper` movements.
2. Changes the orientation to vertical using the `Swing` movement.
3. Extends `Test Grippers` and `Gripper Lifts`
4. Waits for the robot to finish plugging Spacer
5. After the robot plugs the spacers, it will check the sensor readings for spacer position
6. If it's outside of the threshold values defined from Spacer Settings page on HMI
    1. It will Unplug the recently plugged spacer, only on the defected side
    2. And will pick up a new spacer to plugged it again
7. If it is OK, then this sequencer will end, and the process will be started over for any remaining edges by CS_M160L.

2.2.7.1.2 Program Mode Unloading

Unloading sequence of M170 Spacer Application is defined as follows:

1. Waits for the robot to arrive at the vertical position
2. After robot arrives extends `Gripper` and `Test Grippers` to grab plugged spacer in the motherboard
3. Retracts the `Gripper Lifts` and unplugs the spacer from the motherboard
4. Using `Swing Extend and Retract` and `Gripper Extend and Retract` movements will drop the unplugged spacer to M170 Conveyor to be delivered to M200.
5. Then it will check the sensor readings for motherboard position
6. If it's outside of the threshold values defined from Spacer Settings page on HMI
    1. It will try to unplug the last attempted edge, only on the defected side
7. If it is OK, then this sequencer will end, and the process will be started over for any remaining edges by CS_M160U.

2.2.7.1.3 Operator Mode Actions

1. Test Grippers Extend
2. Test Grippers Retract
3. Gripper Lift Extend
4. Gripper Lift Retract
5. Gripper Extend
6. Gripper Retract
7. Swing Extend
8. Swing Retract
9. Spacer Lift Extend
10. Spacer Lift Retract
11. Pushout Extend
12. Pushout Retract

2.2.7.2 M170 Conveyor

This equipment will send the spacers to the appropriate side, depending on the result of the Spacer Application. If Spacer Application decides the spacer has defected in any way, then it will command this conveyor to move that spacer to `West Bin` else all other spacers will drive to M200. This equipment is controlled by ES_M170L or ES_M170U, depending on the selection function of the M2S.

2.2.7.2.1 Program Mode Loading

Loading sequence of M170 Conveyor is defined as follows:

1. It will move to the M200 side unless stated otherwise by M170 Spacer Application
2. If Spacer Application decides the current spacer has defects
    1. It will command M170 Conveyor to move that spacer to `West Bin`
3. If it is not defected it will move to M200 side

2.2.7.2.2 Program Mode Unloading

Unloading sequence of M170 Conveyor is defined as follows:

1. In Unloading move, it will always move all of the spacers to M200

2.2.7.2.3 Operator Mode Actions

1. Jog Forward
2. Jog Reverse
3. Move to M200
4. Move to West Bin

2.2.8 M180

This equipment is for switching between two loaded crates inside/outside to the active area. This equipment will work with the Eurofork and Robot to make sure it is safe and appropriate to switch between crates. It has three distinct moving parts and two different sequencers controlling different parts.

ES_M180M160 will control the rotating itself while ES_M180220 will control the tilting both sides of the Twister.

2.2.8.1 M180 Rotation

This movement will only control the counting of the active crate area and switching between active and passive area crates. Only will be controlled by ES_M180M160.

2.2.8.1.1 Program Mode

The sequence of ES_M180M160 is defined as follows:

1. It will always start as counting A-Side.
2. After counting A side is finished, it switches the crate
3. It will keep counting B side
4. After counting B side, sequencers finishes and starts again from A Side

2.2.8.1.2 Operator Mode Actions

1. Load A-Side to Active Area
2. Load B-Side to Active Area

2.2.8.2 M180 Tilting

This movement will work with the Eurofork to load in crates to the passive area. And will be controlled only by ES_M180M220.

2.2.8.2.1 Program Mode

The sequence of ES_M180M220 is defined as follows:

1. It will wait until counting done on Active area and crates to be switched
2. After crates are switched it waits for Operator to close the lids of the crate
3. After Operator states he/she has closed the lids, it will tilt the crate to 0 degree
4. Commands the Eurofork to pickup crate and place it on the M230
5. Waits for Operator to pickup unloaded crate and load a new one
6. Commands the Eurofork to pickup crate and place it on the M180
7. It will tilt the crate to 7 degree
8. After Operator states he/she has opened the lids, this sequencer will finish and wait for ES_M180M160 to finish counting and rotate the crates

2.2.8.2.2 Operator Mode Actions

1. Tilt A-Side to 7 degree
2. Tilt B-Side to 7 degree
3. Tilt A-Side to 0 degree
4. Tilt B-Side to 0 degree

2.2.9 M190

This equipment is used for identifying the pre-defined edge detects by the line scanner camera. There is a Vertical motion axis controlled by the Program and Camera hardware itself, which is partially controlled by Program. PLC will send a `Program Number` and Run trigger to the camera then will control the position of the camera itself. After transferring the `Run Trigger` the camera runs the specified program number and inspects the motherboard edge for defects. All detection process is programmed on Camera hardware, and it will decide if a given edge has defects or not. Independent from the selected function of the M2S, this equipment always is controlled by ES_M190Cam sequencer. Before starting the inspection, CS_M160L/CS_M160U will pass the control of the Robot to ES_M190Cam, and it will control the Robot.

2.2.9.1 M190 Axis

This Axis has 4 pre-defined positions to use in inspection. 2 for Long edge and 2 for Short Edge.

2.2.9.1.1 Program Mode

The Sequence of ES_M190Cam is defined as follows:

1. Requests robot to move AA edge inspection position and waits for it to arrive
2. Sends Camera Axis to Long Edge Up position
3. Sends an AA side Program No to Camera, and sends a Run Trigger
4. After the camera is ready to move, Moves the Axis to Long Edge Down position
5. Collects the camera results
6. Requests robot to move AB edge inspection position and waits for it to arrive
7. Sends Camera Axis to Short Edge Up position
8. Sends an AB side Program No to Camera, and sends a Run Trigger
9. After the camera is ready to move, Moves the Axis to Short Edge Down position
10. Collects the camera results
11. Requests robot to move BB edge inspection position and waits for it to arrive
12. Sends Camera Axis to Long Edge Up position
13. Sends a BB side Program No to Camera, and sends a Run Trigger
14. After the camera is ready to move, Moves the Axis to Long Edge Down position
15. Collects the camera results
16. Requests robot to move BA edge inspection position and waits for it to arrive
17. Sends Camera Axis to Short Edge Up position
18. Sends a BA side Program No to Camera, and sends a Run Trigger
19. After the camera is ready to move, Moves the Axis to Short Edge Down position
20. Collects the camera results

2.2.9.1.2 Operator Mode Actions

1. Jog Forward
2. Jog Reverse
3. Move Camera to Long Edge Up Position
4. Move Camera to Long Edge Down Position
5. Move Camera to Short Edge Up Position
6. Move Camera to Short Edge Down Position

2.2.9.2 M190 Camera

Even if Axis is controlled by Program, the camera also has its Encoder for vertical movement. And all of the programs on the camera to detect defect sizes are independent of the PLC. The camera has 2 different programs for 2 different edge lengths. Which program number to send on each edge can be selected from the Camera Settings page on the HMI. Also, defect size settings can be found on the same page. For a more in-depth description of ES_M190Cam sequencer for the camera, please read M190 Axis.

2.2.10 M200

This equipment is used for collecting the unplugged spacers for reusing them again by loading to Spacer Magazine. Controlled by ES_M200Elv sequencer, and it is independent of the currently selected function of the M2S.

2.2.10.1 M200 Spacer Collector

M200 will wait for all the spacers on the given motherboard to not cause any slowdowns on the M170 Conveyor. After the last spacer arrives, it will move it to Bin on the backside of the M200.

2.2.10.1.1 Program Mode

The sequence of ES_M200Elv is defined as follows:

1. Waits for the new spacer to arrive at zero position
2. Moves only one step if there are more spacers to unplug on a given motherboard
3. When the last spacer arrives, throws all of the spacers on the elevator buffer to the bin on the backside of the M200.

2.2.10.1.2 Operator Mode Actions

1. Jog Forward
2. Jog Reverse
3. Move One step Up
4. Move Belt size Up

2.2.11 M210

This equipment is to be used by the operator to closing/opening the lids of the passive area crate. It is not used in Program mode in any automatic manner. It will be exclusively controlled by the operator from the junction box on top of it.

2.2.11.1 M210 Man Lift

This equipment doesn't have any automatic actions. But M220 and M180 will not move before it is on down position and all of the parts of it closed.

2.2.11.1.1 Operator Mode Actions

1. Jog Forward
2. Jog Reverse

2.2.12 M220

This equipment is used to transfer crate between pedestal and twister. It has two independent axes. One for the lifting, another one for the conveyor, and both of the movements of this equipment are controlled by ES_M180M220 sequencer, independent of the currently selected function of the M2S.

2.2.12.1 M220 Eurofork Conveyor

Eurofork Conveyor is used to transferring the crate after it has been raised by Eurofork lift to moving it between M230 and M180.

2.2.12.1.1 Program Mode

For a detailed explanation for ES_M180M220 please read M180 Tilting

2.2.12.1.2 Operator Mode Actions

1. Jog Forward
2. Jog Reverse
3. Move to M180 Position
4. Move to M230 Position

2.2.12.2 M220 Eurofork Lift

Eurofork Lift is used to raise the crate before moving it between M230 and M180.

2.2.12.2.1 Program Mode

For a detailed explanation for ES_M180M220 please read M180 Tilting

2.2.12.2.2 Operator Mode Actions

1. Jog Forward
2. Jog Reverse
3. Move to Up Position
4. Move to Down Position

2.2.13 M230

2.3 HMI

2.3.1 Status Header

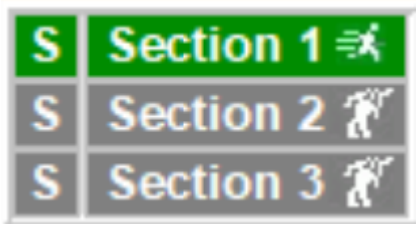
Buttons from left to right in order:

1. Olbricht logo
2. Current alarms
3. Alarms history
4. About and User Management
5. Program Start Permissives
6. Program Start Interlocks
7. Acknowledge / Reset current alarms
8. Section Status indicator for all 3 sections
    1. **-** on Black background indicates given sections is in No Mode
    2. **O** on blue background indicates given section is in Operator Mode
    3. **S** on gray background indicates given section is on Program Mode
    4. **S** on green background indicates given section is on Program Start
9. Current page's title
10. Interlocks for changing the Main Function of the M2S.
11. Request button for function change of the M2S.
12. Status text for the currently selected function of the M2S.
13. User Login button
14. User Logout button
15. Currently logged in user
16. Date/Time information

2.3.1.1 Permissives, Interlocks and Acknowledge Alarms

These permissives and interlocks on the header are for Program Start action. If one of them is red the operator needs to fix issues related to it before starting the section. The operator can use the Ack button anytime to clear the remaining alarms.

2.3.1.2 Header Mode Indicators



These indicators represent the current mode of the 3 sections of M2S.

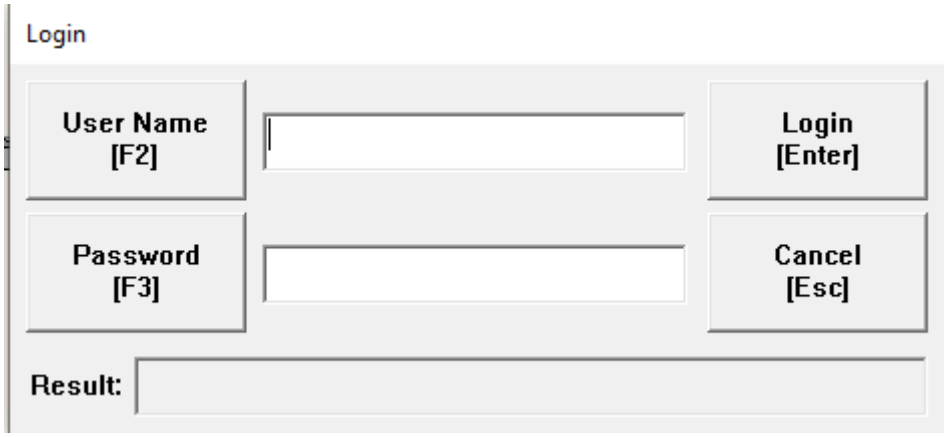
1. **-** on Black background indicates given sections is in No Mode
2. **O** on blue background indicates given section is in Operator Mode
3. **S** on gray background indicates given section is on Program Mode
4. **S** on green background indicates given section is on Program Start

2.3.1.3 Function Indicators and Buttons

The interlock indicator on the left side of the change function button indicates something is blocking the operator from switching the functions. After clearing the interlocks, the operator can switch the function using the `Change Function` button. The current function of the M2S will be indicated on the right side of the change function button.

2.3.1.4 Login

Before starting the operate the machine, the operator must log in first. Using the button with the computer screen and key, HMI will prompt the operator to log in. Using his/her credentials, the operator can login and start operating the M2S.

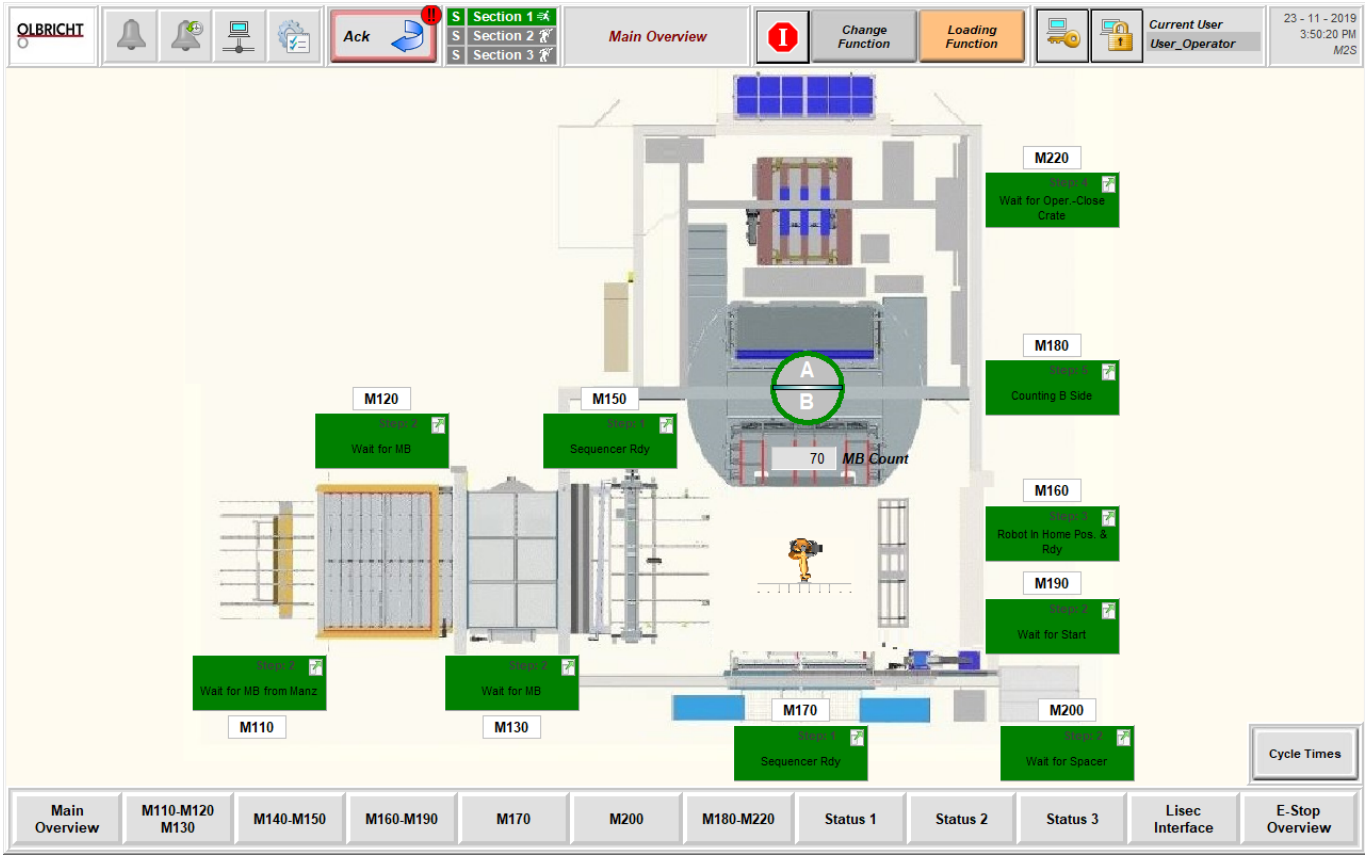


2.3.2 Pages

2.3.2.1 Main Overview

On this screen, you can easily see the whole status of the M2S. 10 independent sequencers are controlling approximately 10 different parts of the line. In-depth information about which sequencers are interlocked/working together can be found General Information part of this document.

In the overview page, the operator can easily see all of these sequencers and their current step. They will change color depending on the status of the sequencer. If there is an error, the sequencer block will change its color to red and throw an alarm to indicate that error status. Otherwise, if given sequencers are in *RUNNING* state, they will change colors to green according to that state.

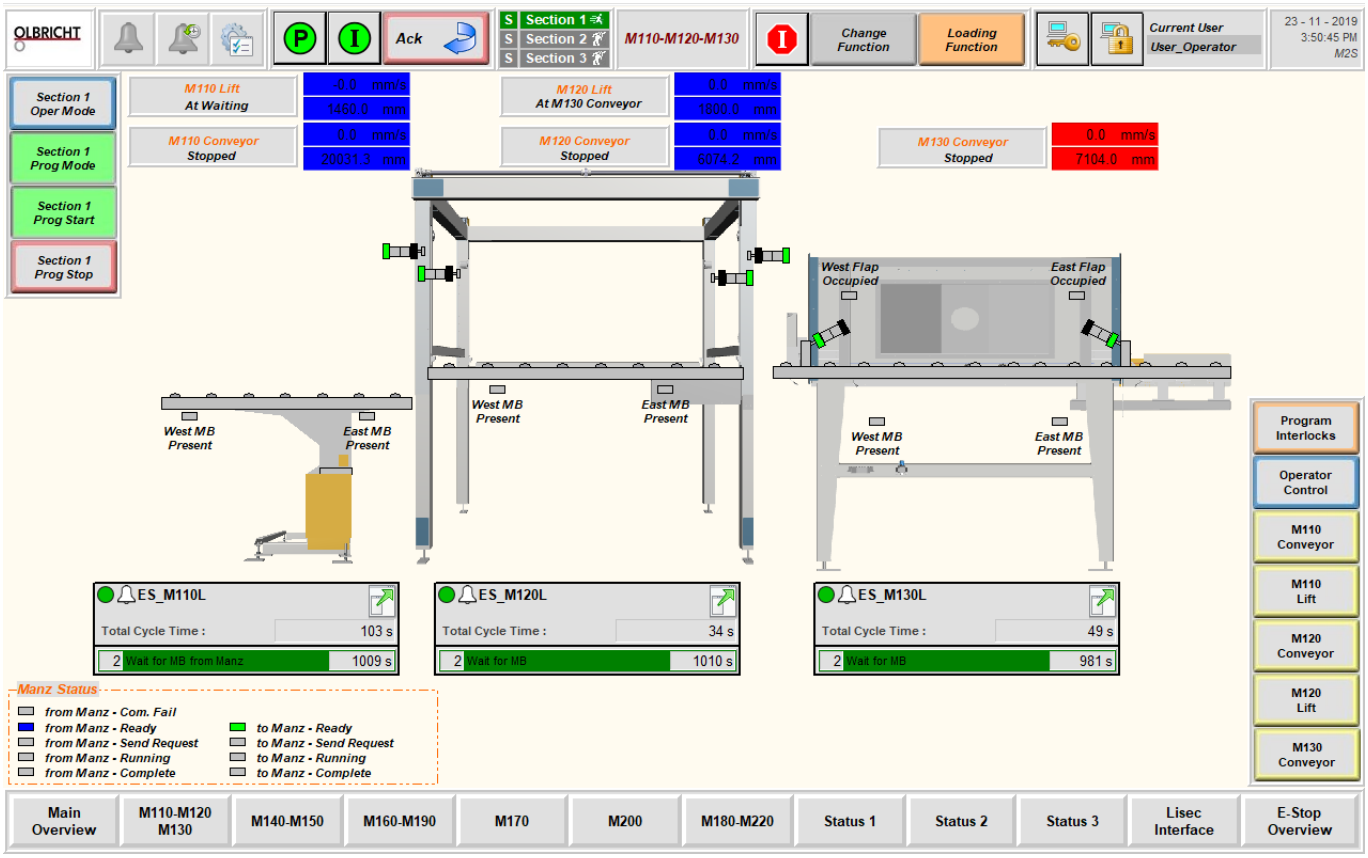


2.3.2.2 M110 M120 M130

This page is where you can control the first three pieces of equipment of the M2S.

1. M110
2. M120
3. M130

Detailed information about each equipment can be found on the Equipments part of this document.



2.3.2.2.1 Mode Change Buttons for Section 1

The operator can change the mode of the `Section-1` in this menu. The selected mode will be highlighted and indicated to the operator, along with the Header Modes Indicator.

1. This button is used to select Operator Mode for `Section1`.
2. This button is used to select Program Mode for `Section 1`.
3. This button is used to start Program Mode for `Section 1`.
4. This button is used to stop Program Mode for `Section 1`.

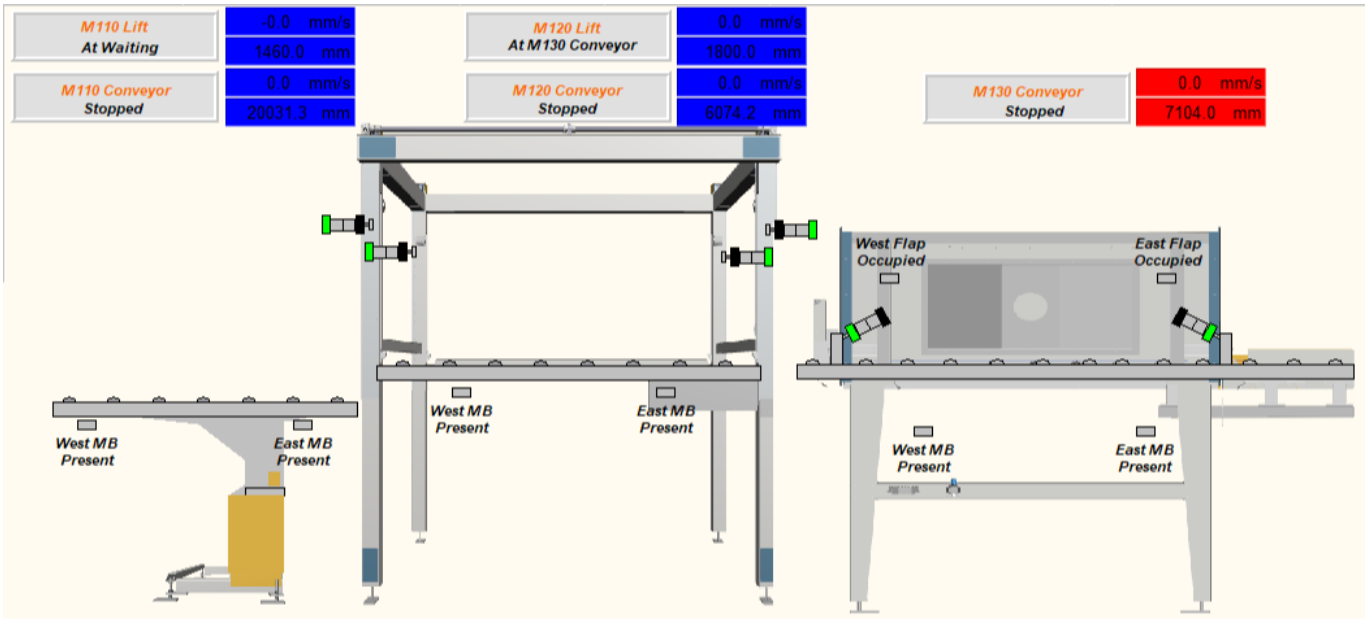
2.3.2.2.2 Manz Status

This window only has indicator lights to provide more in-depth information about Manz-M2S communication. Left indicators, described as from Manz, will light up blue if given Input is active, and will show up as gray if the Input is inactive. Also, for right indicators, described as to Manz, will light up green if given Output is active and will show up as gray if the Output is inactive. More detailed information about the EQ2EQ interface can be found on the documentation supplied by Manz describing that interface.

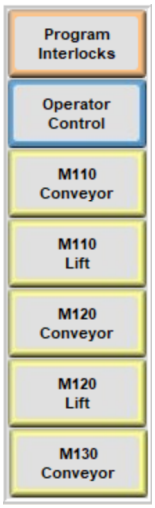
2.3.2.2.3 Conveyor/Sensor statuses

This part of the HMI contains and conveys general information about the selected part. Each conveyor has at least two sensors for motherboard sensing. All of these sensors can be seen in this part. Also, any auxiliary components (pneumatic locks, pneumatic flaps) will show their current status in this part of the HMI. While moving any part, conveyors will light up green and will indicate the moving direction with the arrows.

On the upper side of the conveyor animations, you can find the current position and speed information about each of the axes'. They will also change color depending on the status of the conveyor. They will light up green while in motion, light up blue if they are ready to move and light up red if there is an emergency stop affecting that axis.



2.3.2.2.4 Settings Pages and Operator Control



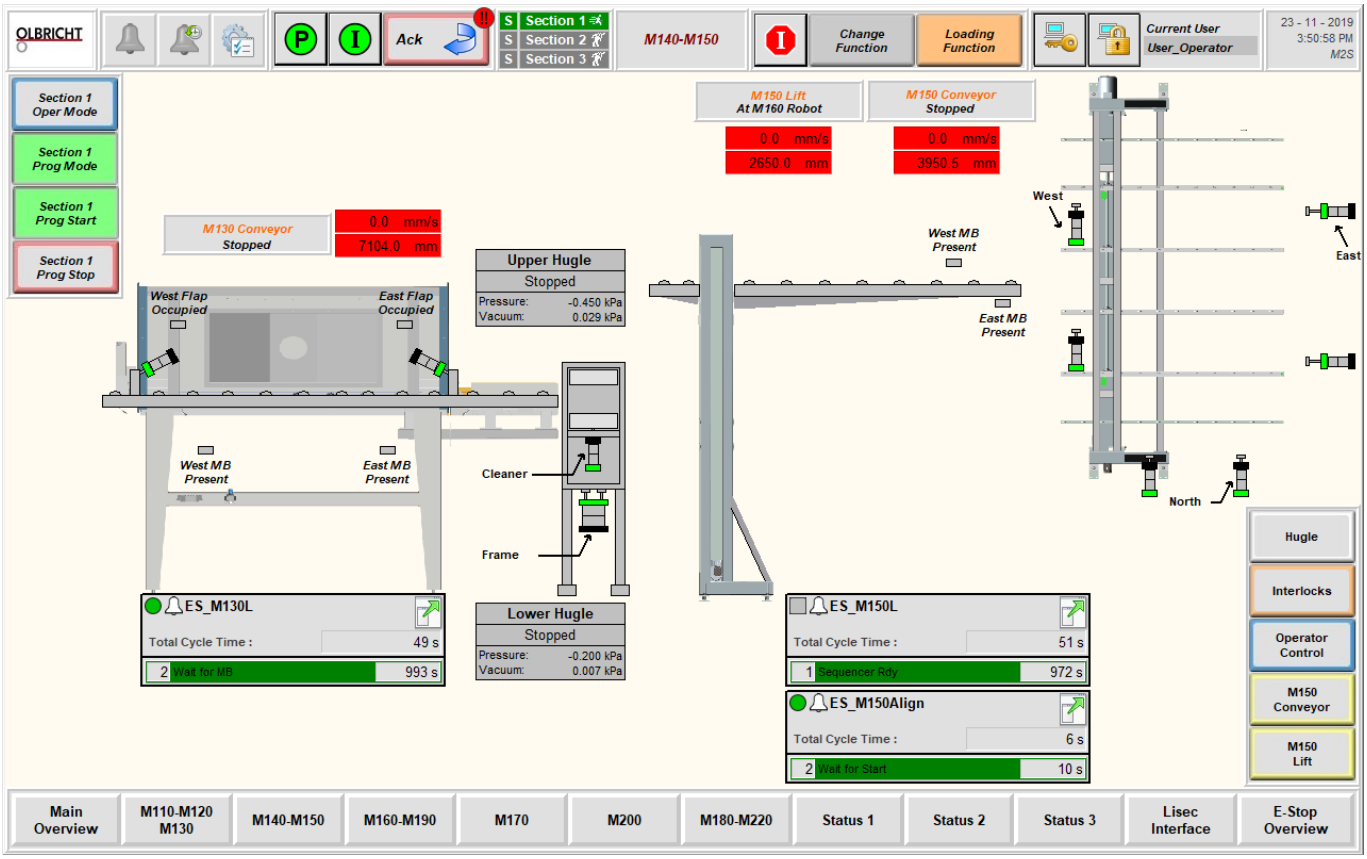
1. Opens up the Program Interlocks page.
2. Opens up the Operator Control page.
3. Opens up the Advanced Axis Control Options for M110 Conveyor.
4. Opens up the Advanced Axis Control Options for M110 Lift.
5. Opens up the Advanced Axis Control Options for M120 Conveyor.
6. Opens up the Advanced Axis Control Options for M120 Lift.
7. Opens up the Advanced Axis Control Options for M130 Conveyor.

2.3.2.3 M140 M150

This page is where you can control the following three pieces of equipment of the M2S.

1. M130
2. M140
3. M150

Detailed information about each equipment can be found on the Equipments part of this document.



2.3.2.3.1 Mode Change Buttons for Section 1

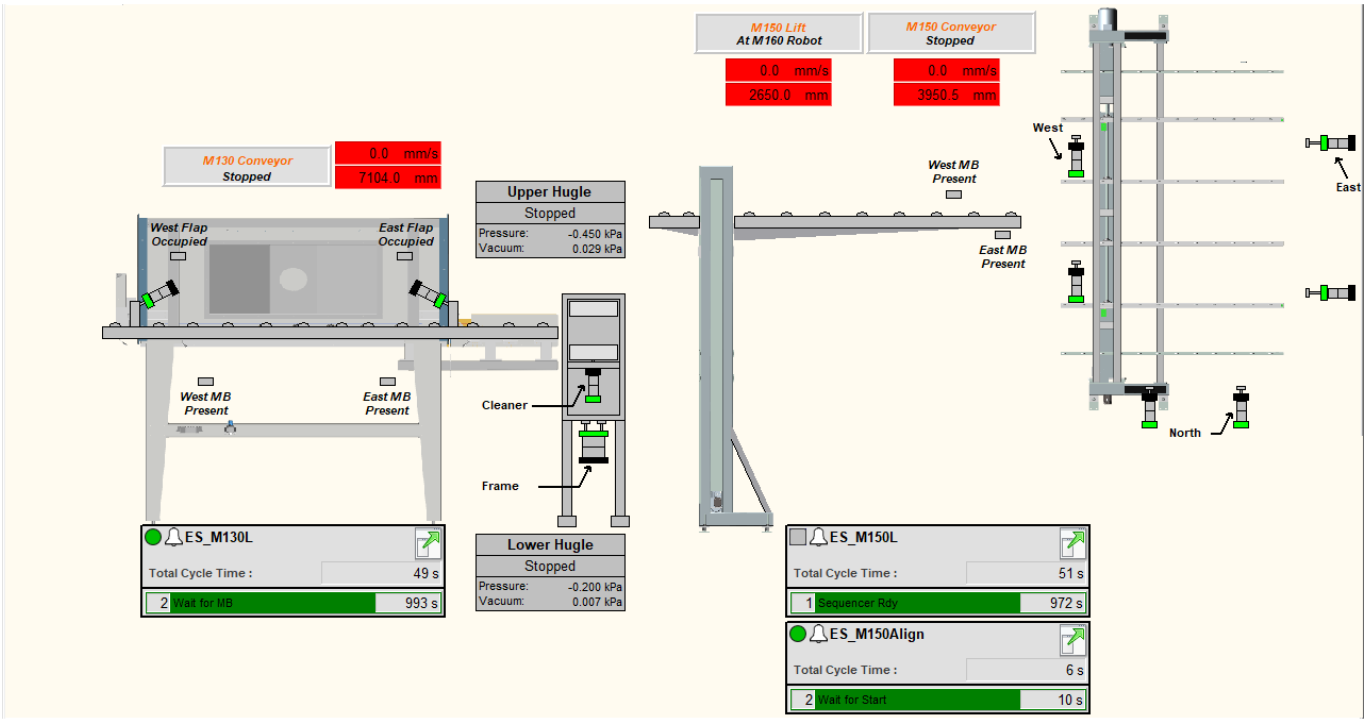
The operator can change the mode of the `Section-1` in this menu. The selected mode will be highlighted and indicated to the operator, along with the Header Modes Indicator.

1. This button is used to select Operator Mode for `Section 1`.
2. This button is used to select Program Mode for `Section 1`.
3. This button is used to start Program Mode for `Section 1`.
4. This button is used to stop Program Mode for `Section 1`.

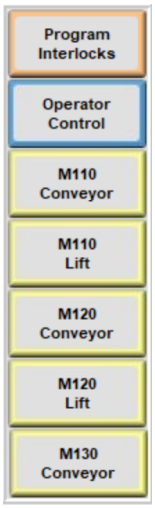
2.3.2.3.2 Conveyor/Sensor/Hugle statuses

This part of the HMI contains and conveys general information about the selected section. Each conveyor has at least two sensors for motherboard sensing. All of these sensors can be seen in this part. Also, any auxiliary components (pneumatic locks, flaps, and pushers) will show their current status in this part of the HMI. While moving any part, conveyors will light up green and will indicate the moving direction with the arrows.

On the upper side of the conveyor animations, you can find the current position and speed information about each of the axes'. They will also change color depending on the status of the conveyor. They will light up green while in motion, light up blue if they are ready to move and light up red if there is an emergency stop affecting that axis.



2.3.2.3.3 Settings Pages and Operator Control



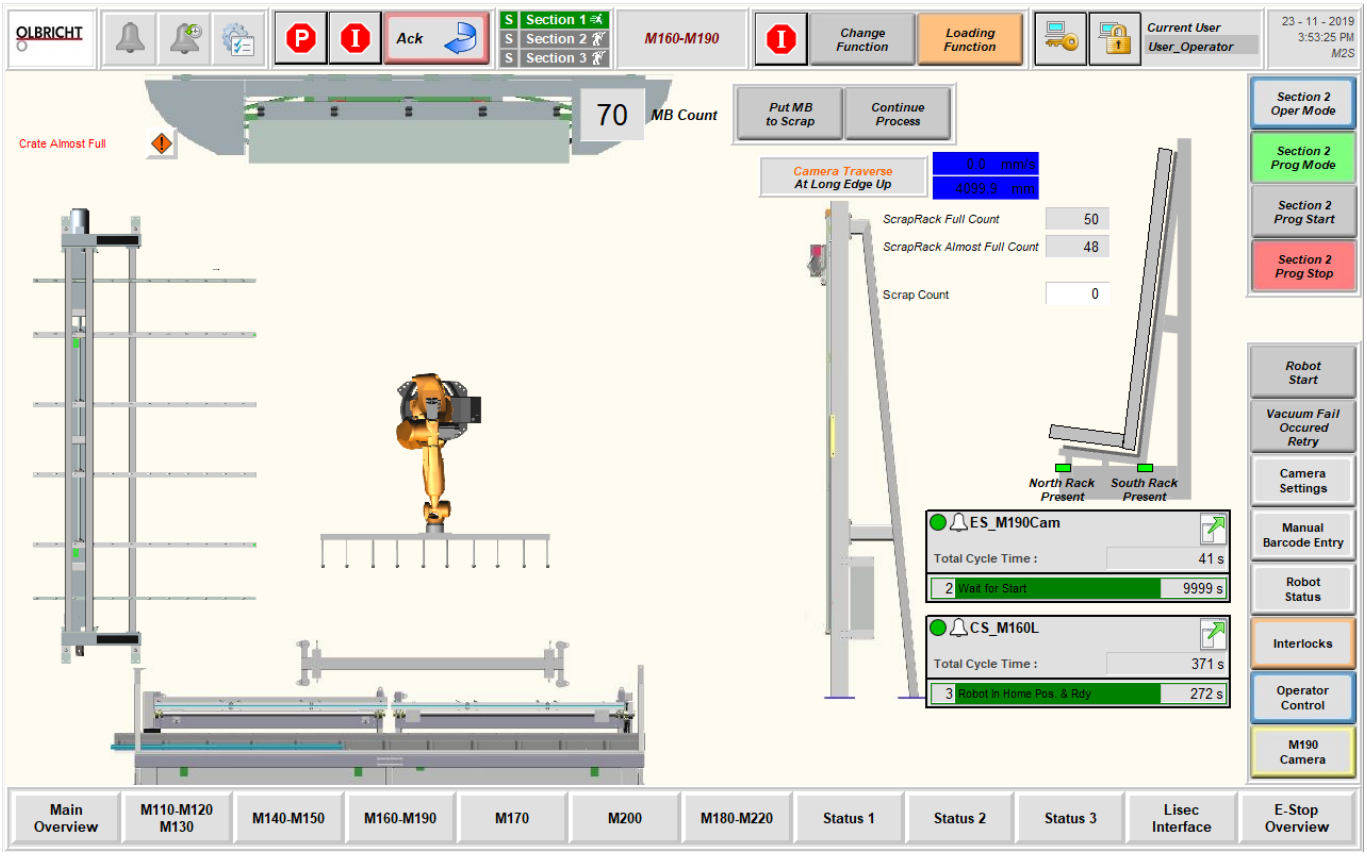
1. Opens up the Hugle Options page
2. Opens up the Program Interlocks page.
3. Opens up the Operator Control page.
4. Opens up the Advanced Axis Control Options for M150 Conveyor.
5. Opens up the Advanced Axis Control Options for M150 Lift.

2.3.2.4 M160 M190

This page is where you can control the following three pieces of equipment of the M2S.

1. M160
2. M190
3. Scrap Rack

Detailed information about each equipment can be found on the Equipments part of this document.



2.3.2.4.1 Mode Change Buttons for Section 2

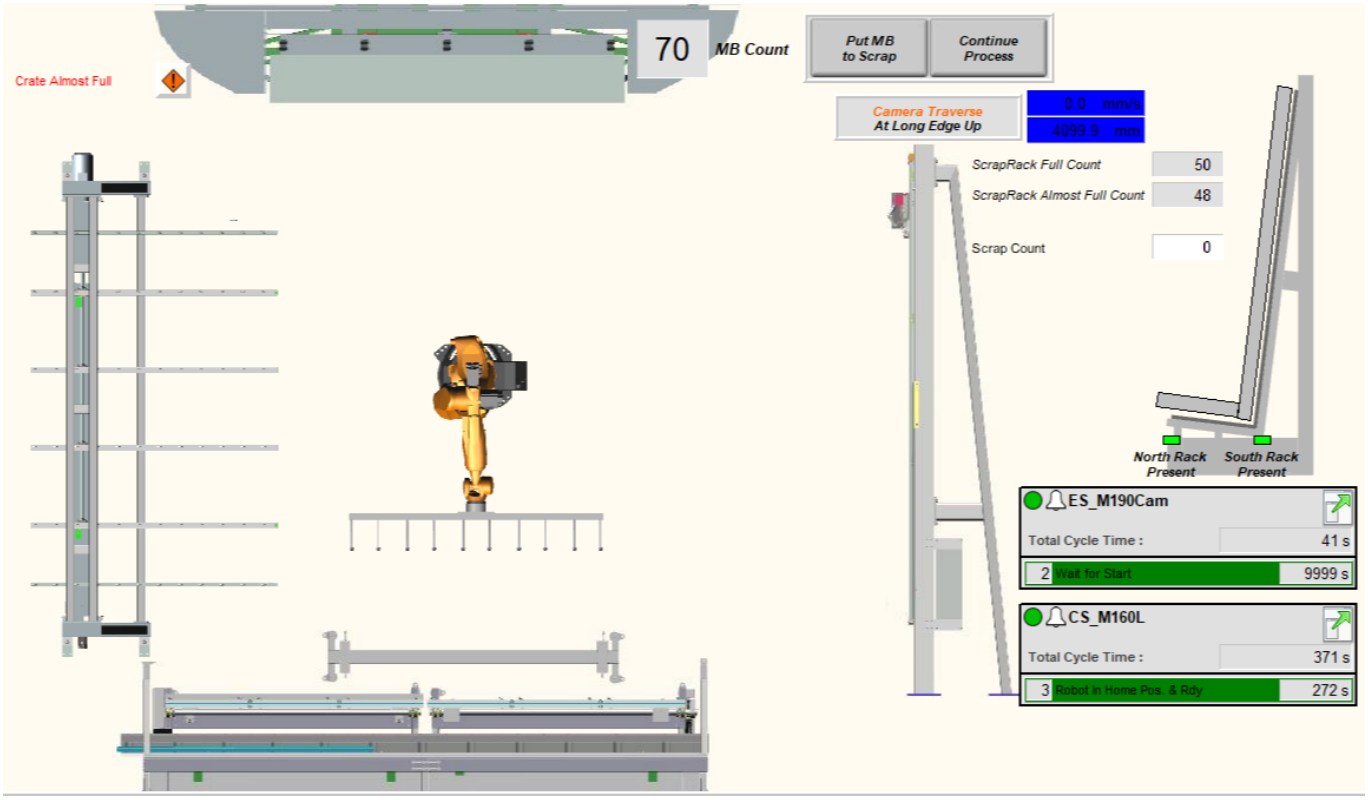
The operator can change the mode of the `Section-2` in this menu. The selected mode will be highlighted and indicated to the operator, along with the Header Modes Indicator.

1. This button is used to select Operator Mode for `Section 2`.
2. This button is used to select Program Mode for `Section 2`.
3. This button is used to start Program Mode for `Section 2`.
4. This button is used to stop Program Mode for `Section 2`.

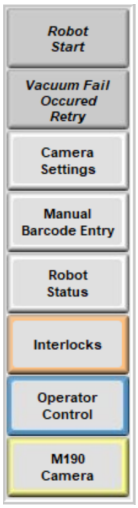
2.3.2.4.2 Robot Cell Status

This part of the HMI contains and conveys general information about the robot cell. The operator can easily see:

- How many motherboards in the current crate
- How many motherboards in the scrap, if installed
- ID and Process State of the motherboard robot moves currently
- Which sides of the motherboard are currently plugged/unplugged
- Status of the camera check for each edge
- Current position and speed of the camera axis

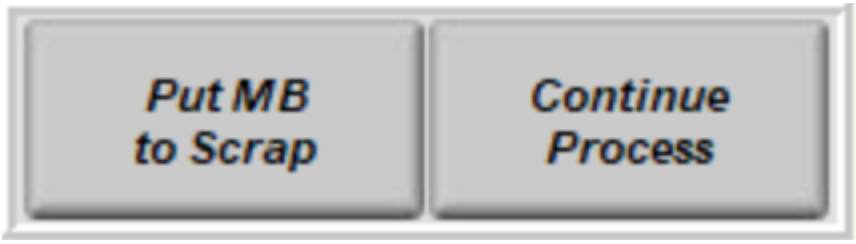


2.3.2.4.3 Settings Pages and Operator Control



1. Sends an Enable signal to Robot, it will light up green to indicate the robot is ready to move
2. If any Vacuum failure happens while trying to pick up the motherboard, the robot goes back home, then the operator can use this button command robot to try again with more aggressive settings.
3. Opens up the Camera Settings page.
4. Opens up the Manual Barcode Entry page.
5. Opens up the Robot Status/Diagnostics page.
6. Opens up the Program Interlocks page.
7. Opens up the Operator Control page.
8. Opens up the Advanced Axis Control Options for M190 Camera Axis.

2.3.2.4.4 Camera Inspection Check Overrides

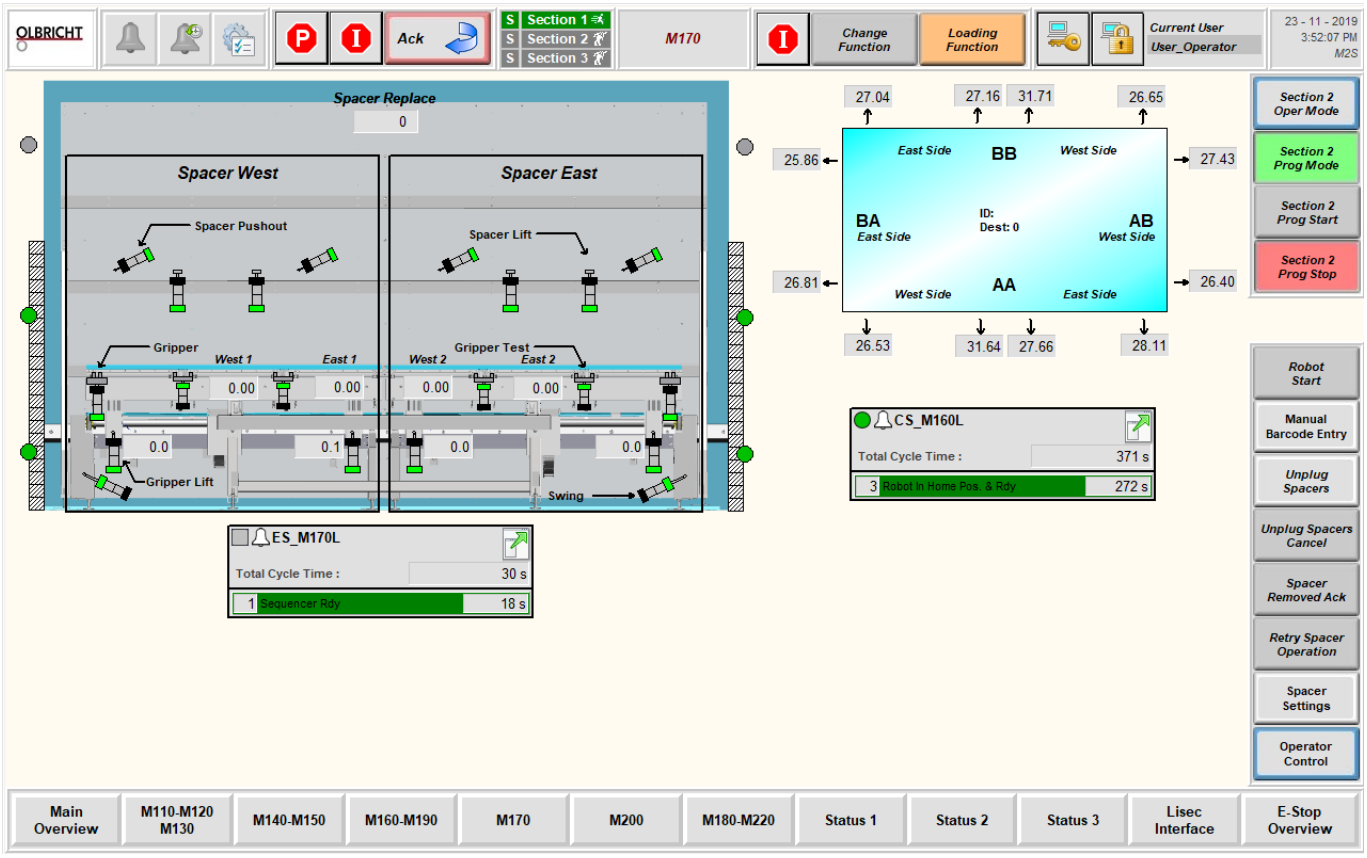


After checking the inspection results from the camera, the operator can follow up with two different actions if the results have defects.

1. The Operator can command the program to place the current motherboard to Scrap, following camera results.
2. The Operator can command the program to disregard camera results and continue the process

2.3.2.5 M170

This page is solely for spacer operations on the line. The Operator can easily see current states of the pneumatics on spacer application outlet, visual and sensor output results of the last plug or unplug action.



2.3.2.5.1 Mode Change Buttons for Section 2

The operator can change the mode of the `Section-2` in this menu. The selected mode will be highlighted and indicated to the operator, along with the Header Modes Indicator.

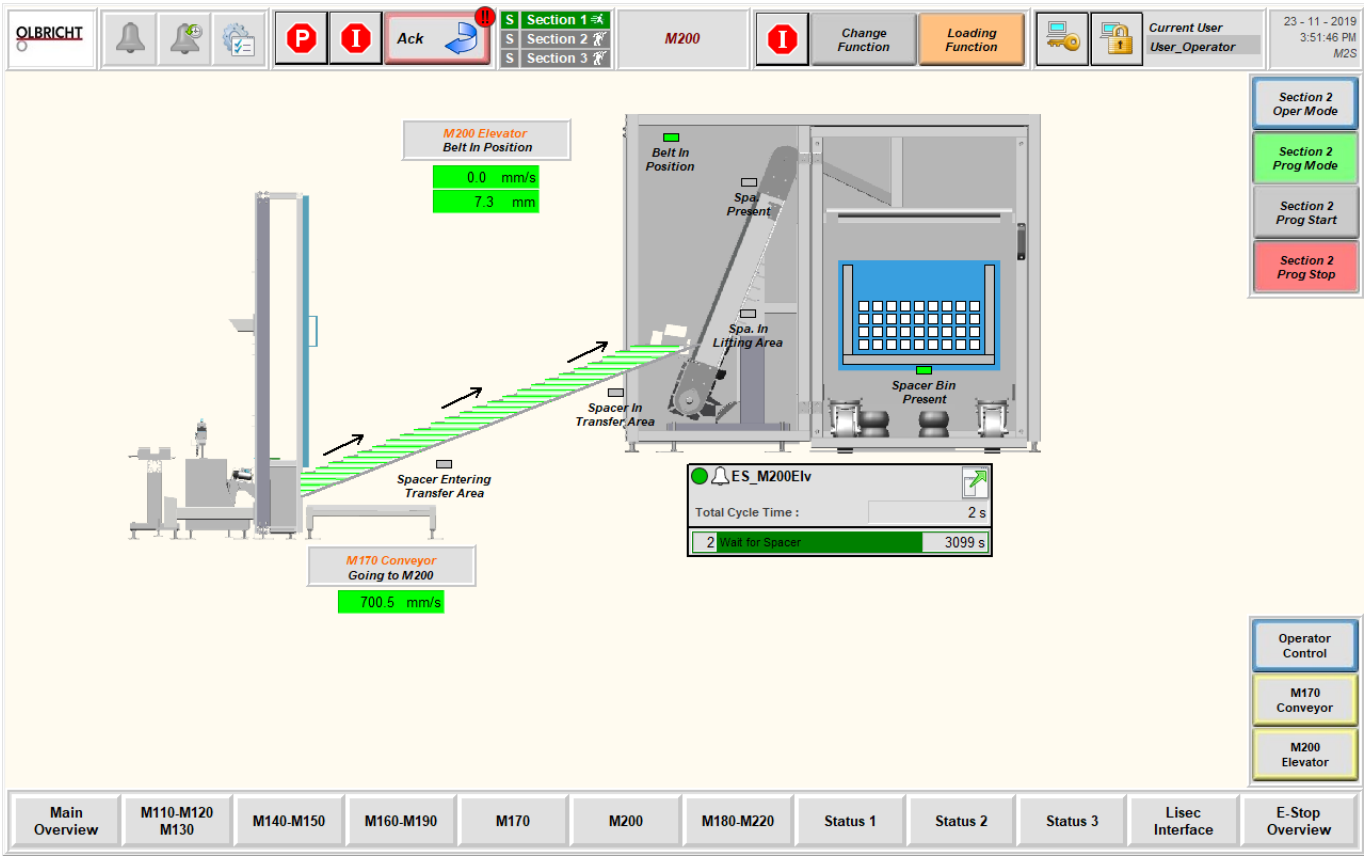
1. This button is used to select Operator Mode for `Section 2`.
2. This button is used to select Program Mode for `Section 2`.
3. This button is used to start Program Mode for `Section 2`.
4. This button is used to stop Program Mode for `Section 2`.

2.3.2.5.2 Settings Pages and Operator Control

1. Sends an Enable signal to Robot, it will light up green to indicate robot is ready to move
2. Opens up the Manual Barcode Entry page.
3. While spacer plug operation in progress, at any time operator can use this button to automatically unplug all of the spacers and start the plugging process from the start.
4. Cancels currently active unplug request from the operator
5. If the program decides it has failed to remove or plug spacer, it will retry a set amount of time. Then it will prompt the operator to choose follow up action. If the operator uses this button, the program will assume it successfully removed the spacer and failed to detect it through sensors. So the operation will continue as ordinary.
6. If the program decides it has failed to remove or plug spacer, it will retry a set amount of time. Then it will prompt the operator to choose follow up action. If the operator uses this button, the system will try again a set amount of time.
7. Opens up the Spacer Settings page.
8. Opens up the Operator Control page.

2.3.2.6 M200

This page is solely for the spacer collector outlet on the line. The operator can easily see the current state of the conveyors and sensors.

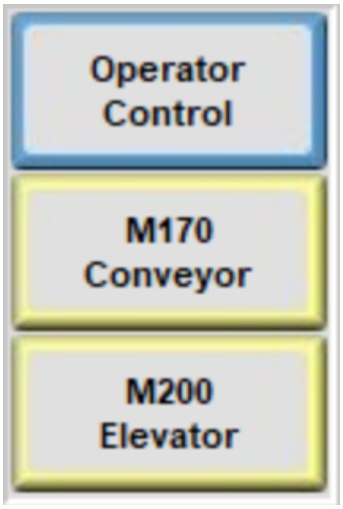


2.3.2.6.1 Mode Change Buttons for Section 2

The operator can change the mode of the `Section-2` in this menu. The selected mode will be highlighted and indicated to the operator, along with the Header Modes Indicator.

1. This button is used to select Operator Mode for `Section 2`.
2. This button is used to select Program Mode for `Section 2`.
3. This button is used to start Program Mode for `Section 2`.
4. This button is used to stop Program Mode for `Section 2`.

2.3.2.6.2 Settings Pages and Operator Control



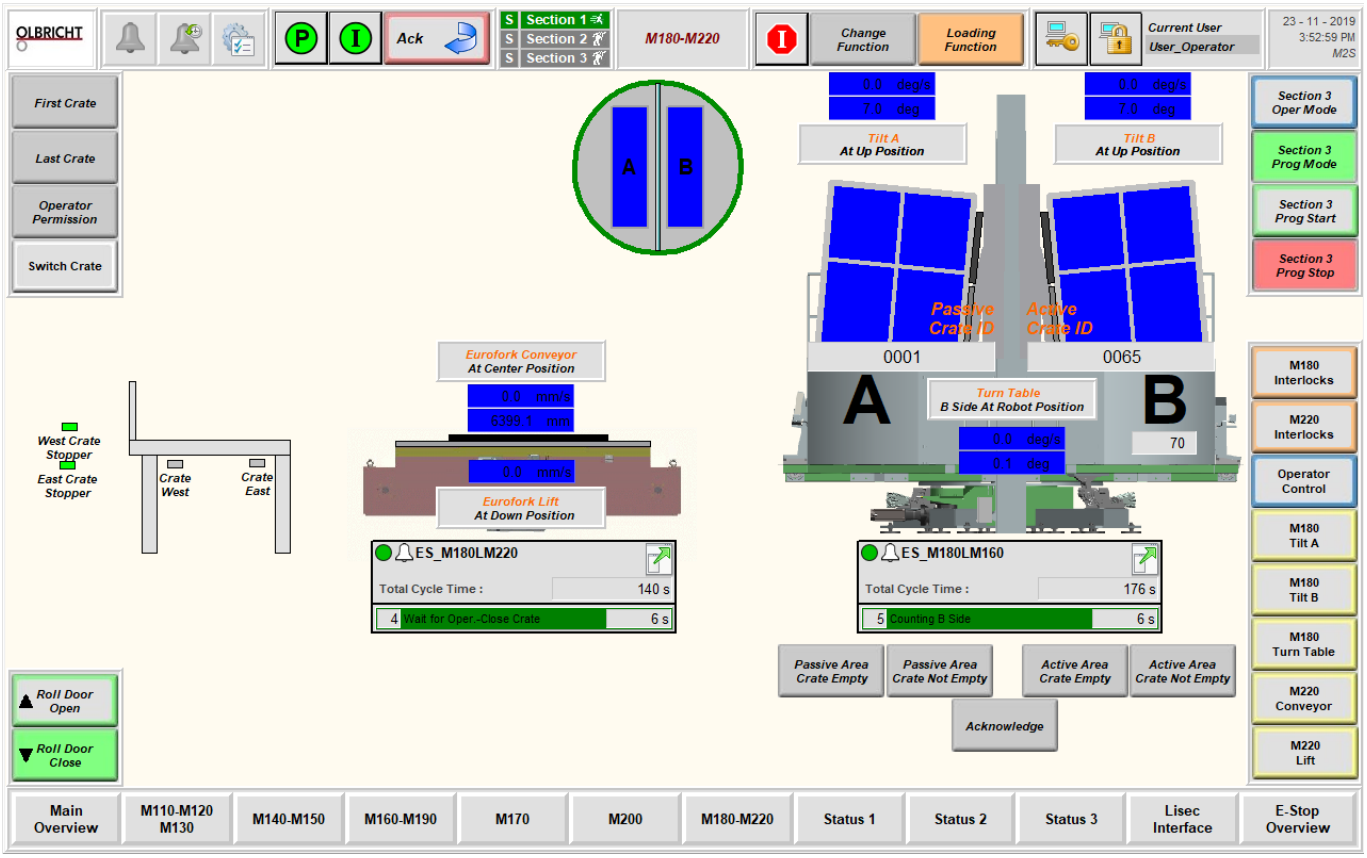
1. Opens up the Operator Control page.
2. Opens up the Advanced Axis Control Options for M170 Conveyor Axis.
3. Opens up the Advanced Axis Control Options for M200 Elevator Axis.

2.3.2.7 M180-M220

This page is where you can control the following three pieces of equipment of the M2S.

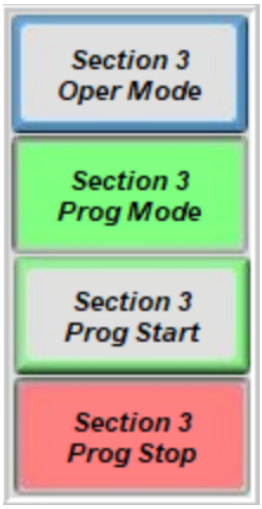
1. M180
2. M220
3. M230

Detailed information about each equipment can be found on the Equipments part of this document.



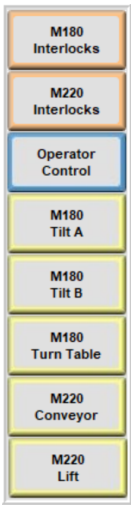
2.3.2.7.1 Mode Change Buttons for Section 3

The operator can change the mode of the `Section-3` in this menu. The selected mode will be highlighted and indicated to the operator, along with the Header Modes Indicator.



1. This button is used to select Operator Mode for `Section 3`.
2. This button is used to select Program Mode for `Section 3`.
3. This button is used to start Program Mode for `Section 3`.
4. This button is used to stop Program Mode for `Section 3`.

2.3.2.7.2 Settings Pages and Operator Control



1. Opens up the Program Interlocks page for M180.
2. Opens up the Program Interlocks page for M220.
3. Opens up the Operator Control page.
4. Opens up the Advanced Axis Control Options for M180 Tilt A Axis.
5. Opens up the Advanced Axis Control Options for M180 Tilt B Axis.
6. Opens up the Advanced Axis Control Options for M180 Rotation Axis.
7. Opens up the Advanced Axis Control Options for M220 Conveyor Axis.
8. Opens up the Advanced Axis Control Options for M220 Lift Axis.

2.3.2.7.3 Crate Operation Controls

1. For a first starting-up state, the operator must use this button to indicate. This first crate will be directly loaded to the active area side. This option should be provided while the crate is on M230.
2. For a shutting down after removing the passive area crate from twister first, the program will wait for the operator to load new crate, in this state using Last Crate button will skip that wait and after rotating the last active area crate to the passive area, it will continue to move that last crate to M230.
3. The operator will use this button to indicate he/she completed the requested action, i.e. opening or closing the crate after in the passive area.
4. If any side of the crate has a Partial (Not full or empty) crate operator should use this button to engage the rotation of the crates for any operation.

2.3.2.7.3 Roll Door Controls

In ordinary operation, the operator doesn't need to use these buttons. The program will open/close them in the appropriate times.

1. Used for opening the roll door
2. Used for closing the roll door

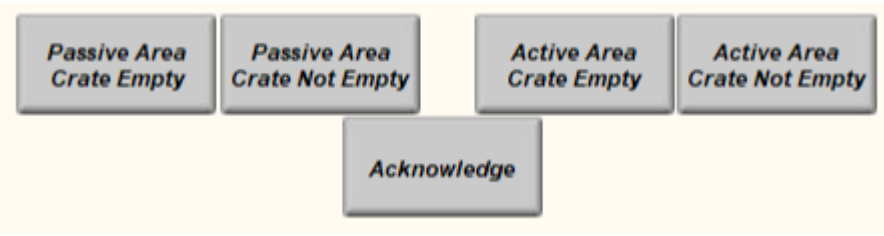
2.3.2.7.4 Lisec Crate Reporting Controls

Before rotating any crate in and out operator needs to answer 2 questions about the crates.

1. Is the passive area crate Empty? (the crate which will rotate into Robot Side)
2. Is the active area crate Empty? (the crate which will rotate out from Robot Side)

Passive Area Options are on the left, which corresponds to the Passive Area side of the M180, and Active Area Options are on the right, which corresponds to the Active Area side of the M180.

Crate Empty and Crate Not Empty options are mutually exclusive. The operator should select one for each side then press the Acknowledge button right below them to send that information to Lisec. And selections are permanent and will stay as last selected one until the operator changes the selection.

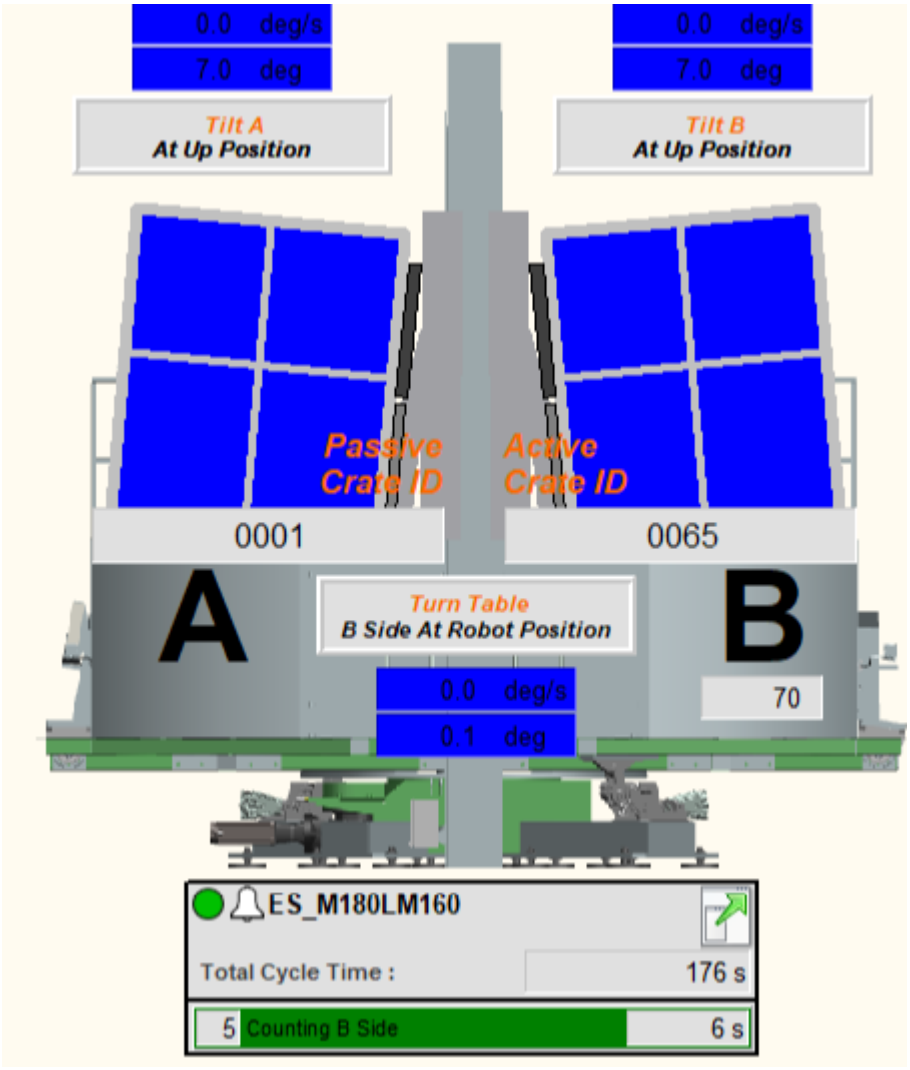


1. Selection to indicate passive area crate is empty
2. Selection to indicate passive area crate is not empty
3. Selection to indicate active area crate is empty
4. Selection to indicate active area crate is not empty
5. Button to confirm the operator has selected the correct information to send Lisec.

2.3.2.7.3 Twister Status

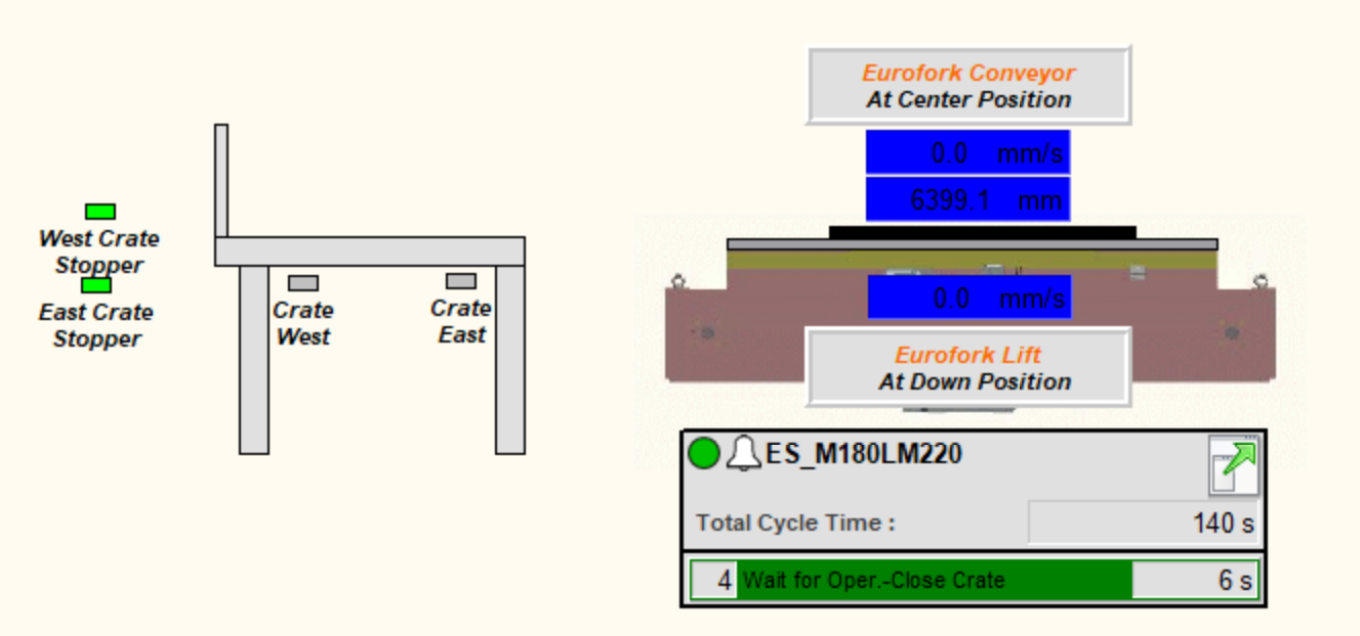
This part of the HMI contains and conveys general information about the Twister. The operator can easily see :

- How many motherboards in the active area crate, and it's ID
- Passive area crate ID
- Current tilt positions of both sides and current speed of that axes' if it is moving
- Current position and angular speed of the twister rotation



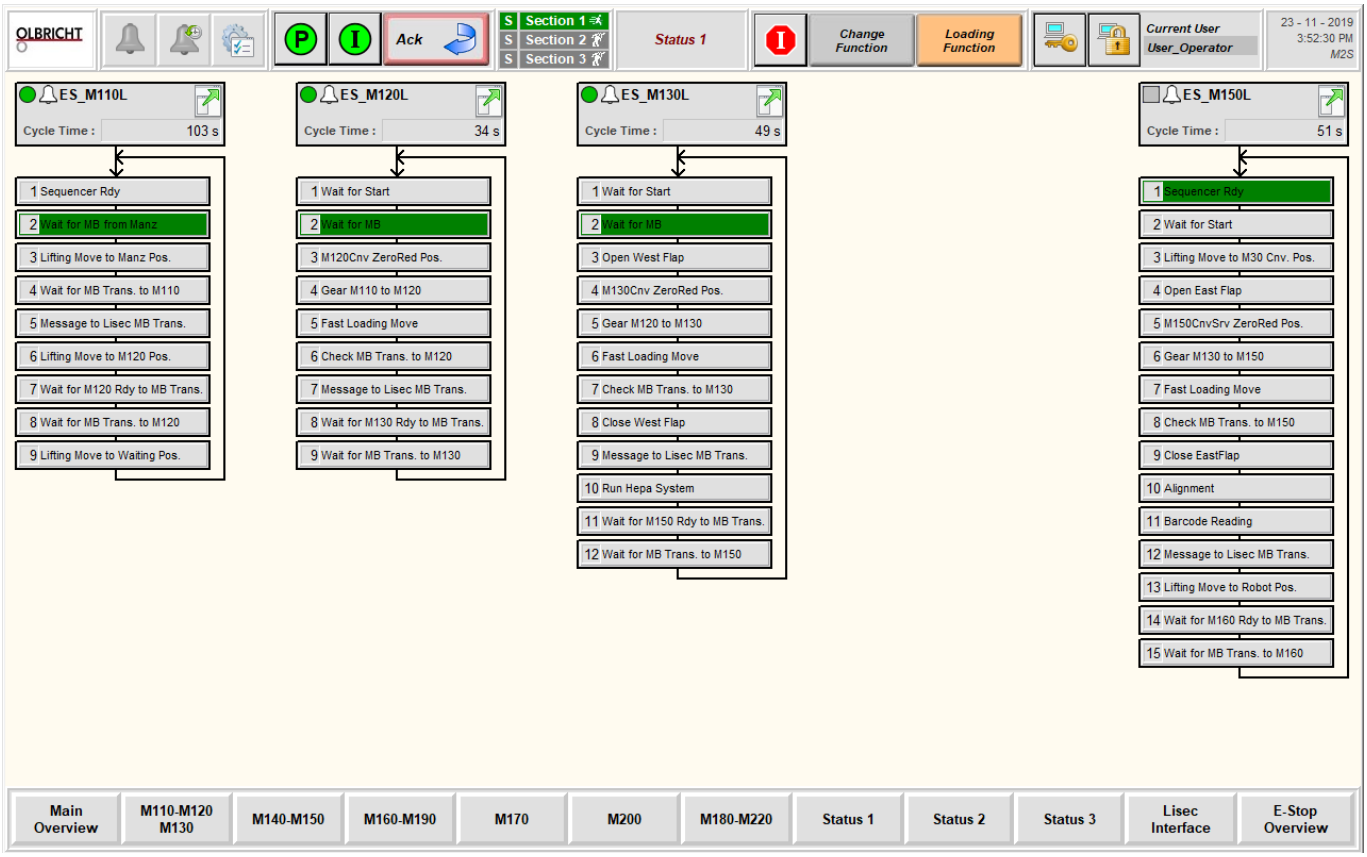
2.3.2.7.4 Eurofork and Pedestal Status

This section of the page shows the current speed of the Eurofork on Both axes' and position of the Eurofork conveyor. It will animate according to the position of the Eurofork Conveyor axis. It also shows the current status of the Pedastal sensors.



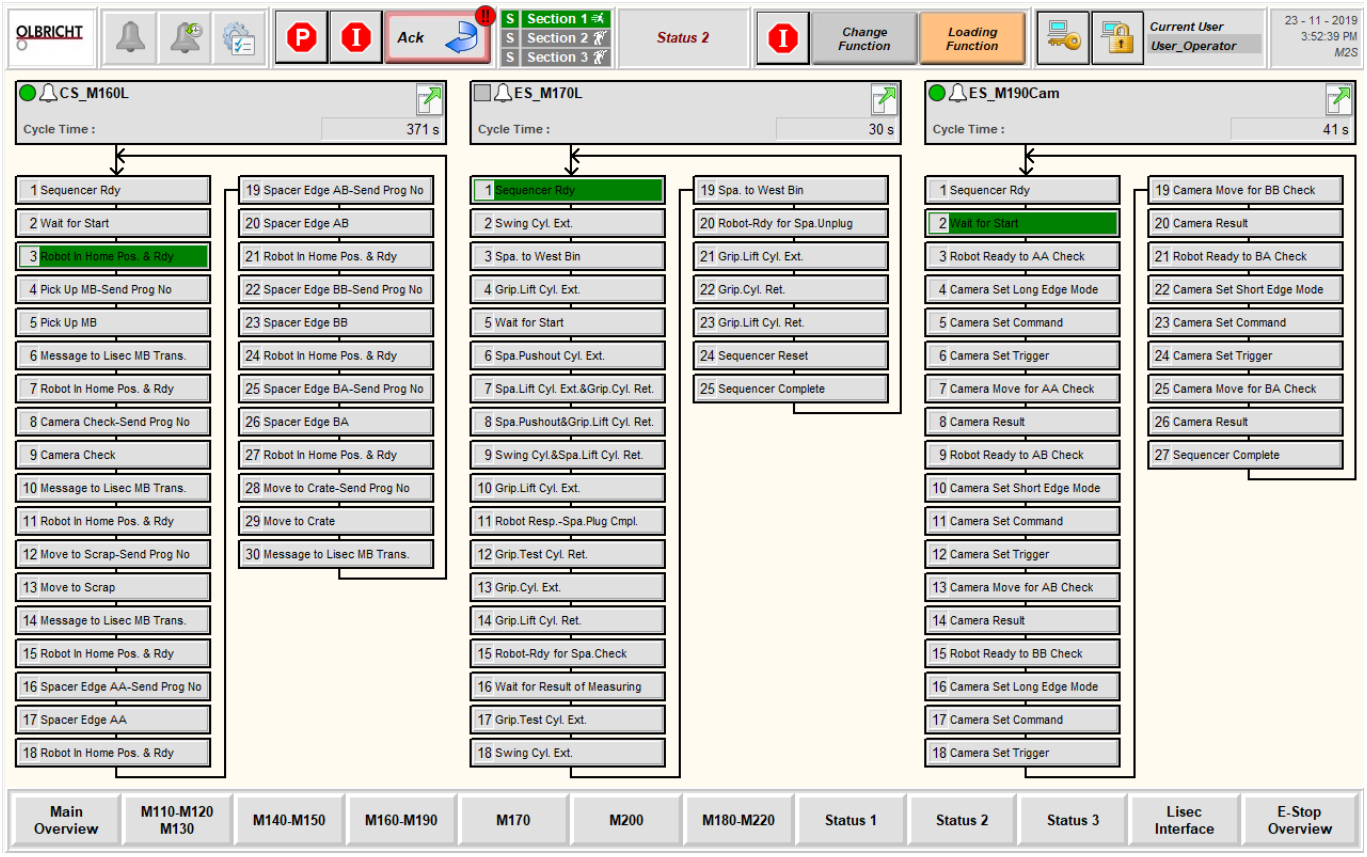
2.3.2.8 Status Zone 1

This page contains all of the sequencers responsible for `Section 1` to operate. It is designed as the first point of Troubleshooting. If one of the equipment is not working as expected, a maintenance individual can open up this page and investigate the issue. More information about using sequencers faceplate can be found Sequencers section of this document.



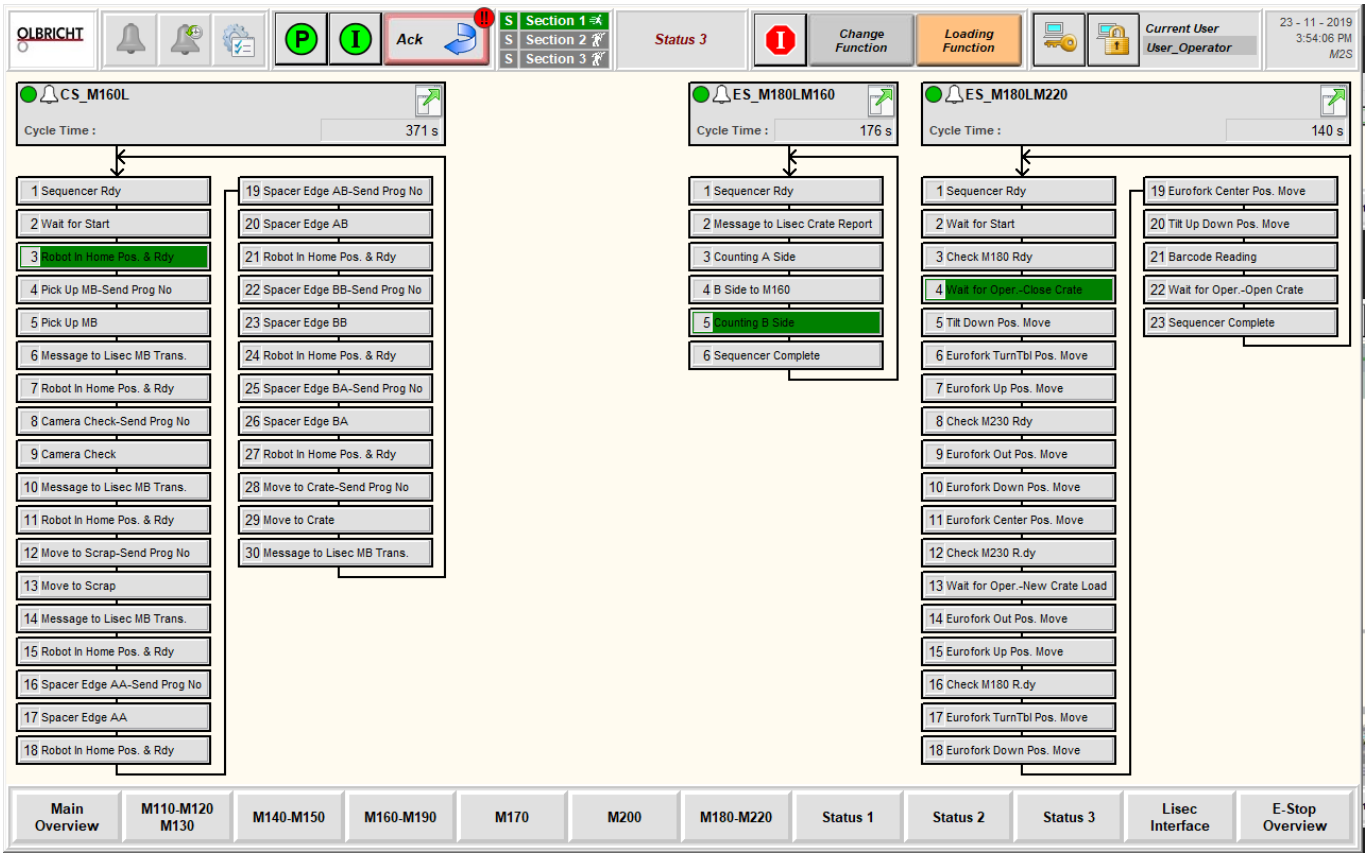
2.3.2.9 Status Zone 2

This page contains all of the sequencers responsible for `Section 2` to operate. It is designed as the first point of Troubleshooting. If one of the equipment is not working as expected, a maintenance individual can open up this page and investigate the issue. More information about using sequencers faceplate can be found Sequencers section of this document.



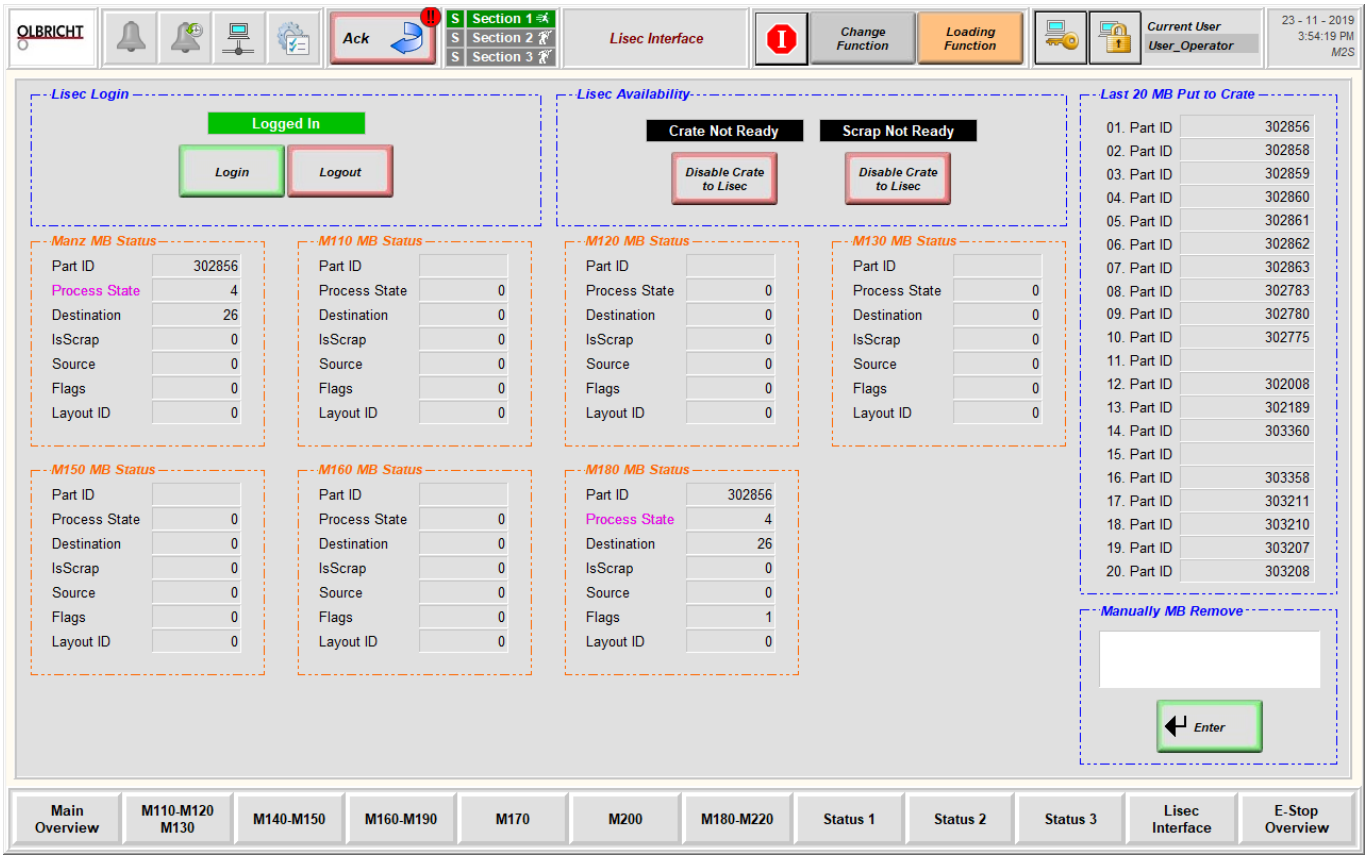
2.3.2.10 Status Zone 3

This page contains all of the sequencers responsible for `Section 3` to operate. It is designed as the first point of Troubleshooting. If one of the equipment is not working as expected, a maintenance individual can open up this page and investigate the issue. More information about using sequencers faceplate can be found Sequencers section of this document.



2.3.2.11 Lisec Interface

This page contains information usually related to Lisec. The operator can log in or Logout from Lisec, Send a manually removed panel number to Lisec or declare M2S Crate or Scrap as `Not available` for Lisec's routing purposes. For ease of use, all of the motherboards currently on the M2S and Last 20 motherboards put to the crate is shown in this page. So the operator can easily determine the ID of the motherboard he/she wants to remove from Lisec.



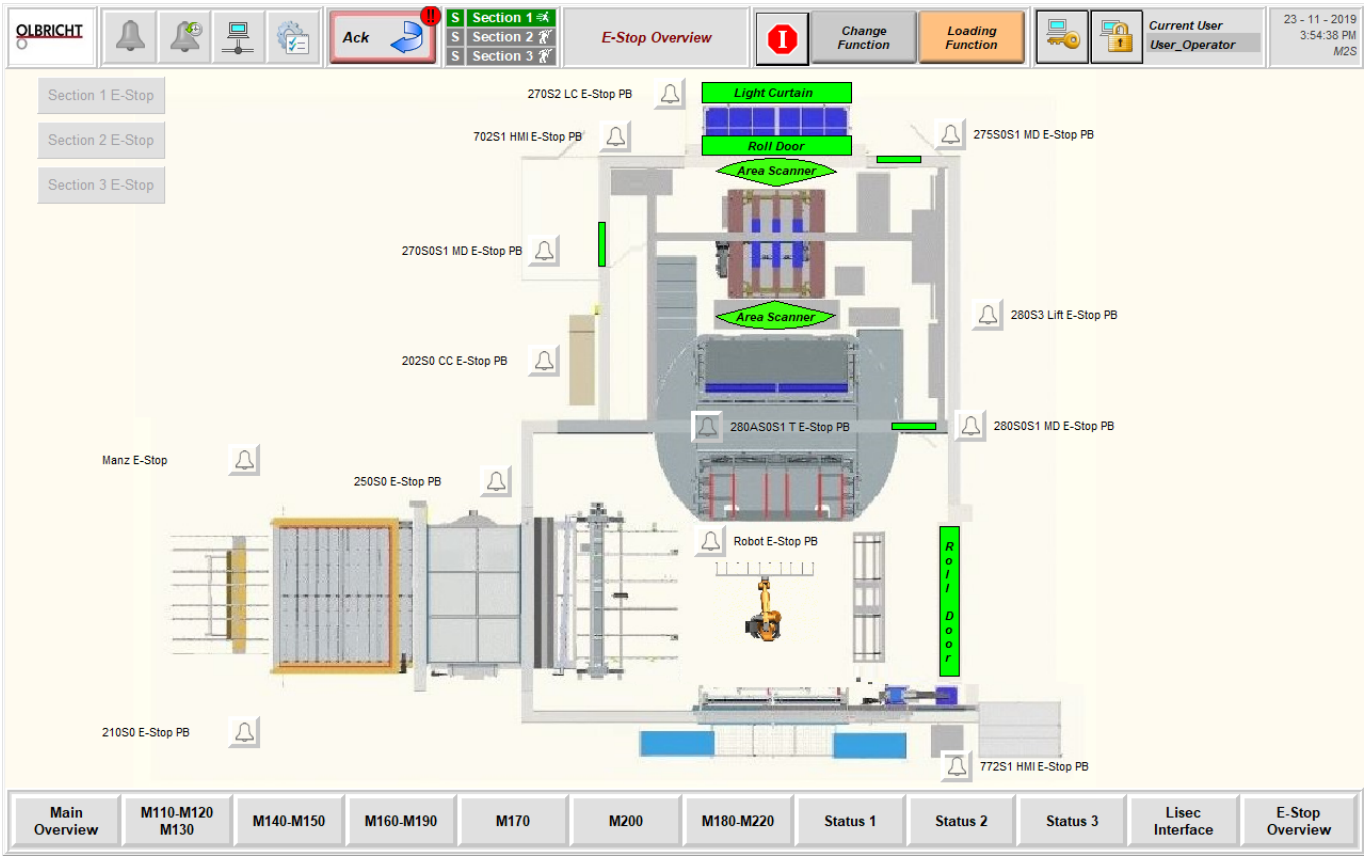
2.3.2.11.1 Manually Removing Motherboards

If for any reason, operator removes the motherboard from conveyors or from the crate, operator must use this field to keep data integrity between Lisec and M2S intact.

To indicate any removal from the M2S, operator must use field under `Manually MB Remove` part of the page. Clicking it will pop-up a keyboard for Part ID entry. All of the tracked parts on the conveyors and last 20 motherboards loaded to crates are provided in this page to make identifying the removed motherboard easy for operator. After entering the Part ID in the keyboard, and pressing Enter button, M2S will send a MB removed message to Lisec. The values on the `Lisec Interface` page will stay the same until it is overridden by another motherboard.

2.3.2.12 E-Stop Overview

In this page operator can found an overview of the line, containing all of the safety triggers with descriptions. If one of them is used or tripped it can be easily seen on this page with red markers.



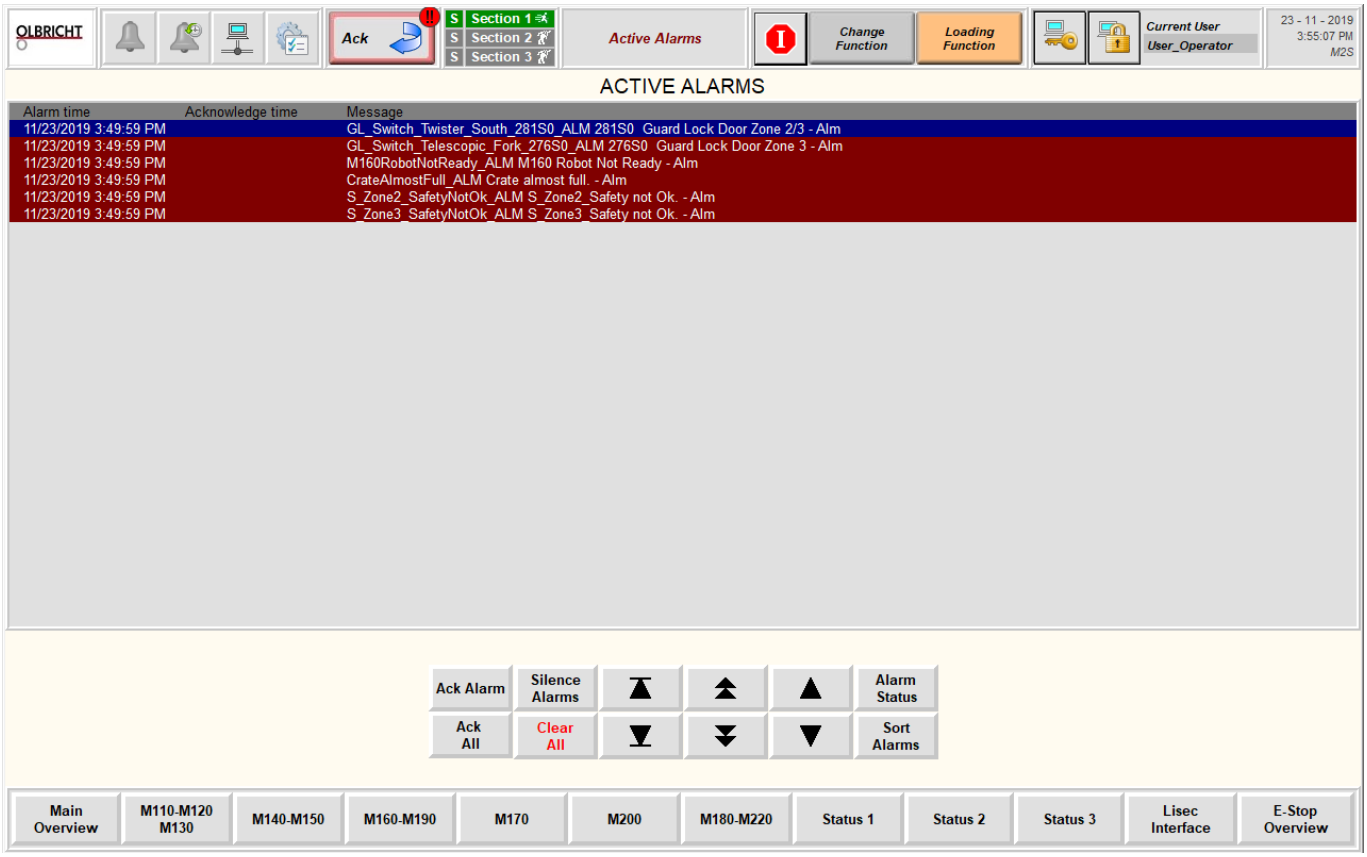
2.3.3 Pop-ups

2.3.3.1 Alarms

2.3.3.1.1 Active Alarms Page

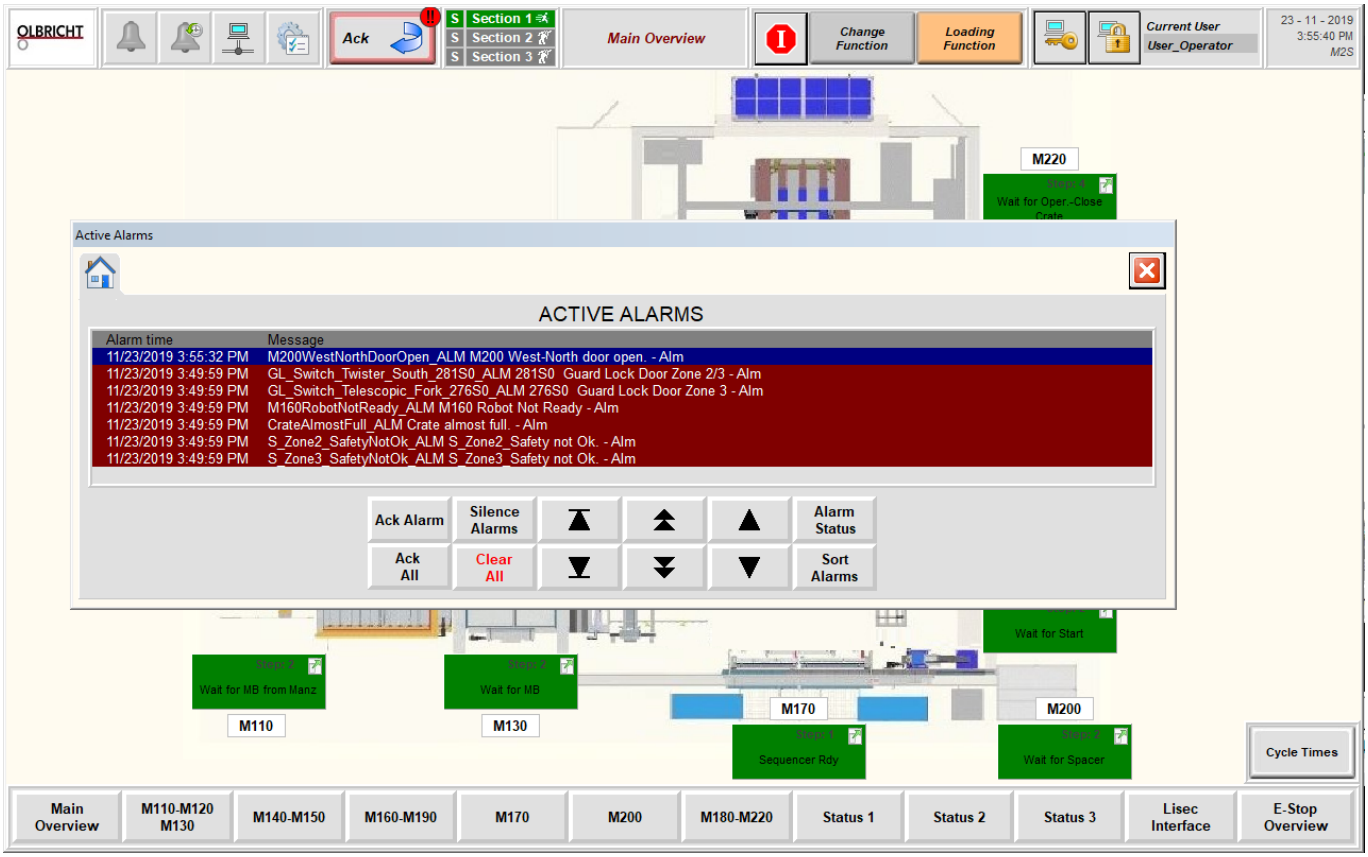
This page contains the alarms currently on the tripped state, sorted chronologically. And they can be acknowledged one by one or all together.

Active Alarms Page can be accessed by pressing the top left `Bell Icon`.



2.3.3.1.2 Active Alarms Pop-up

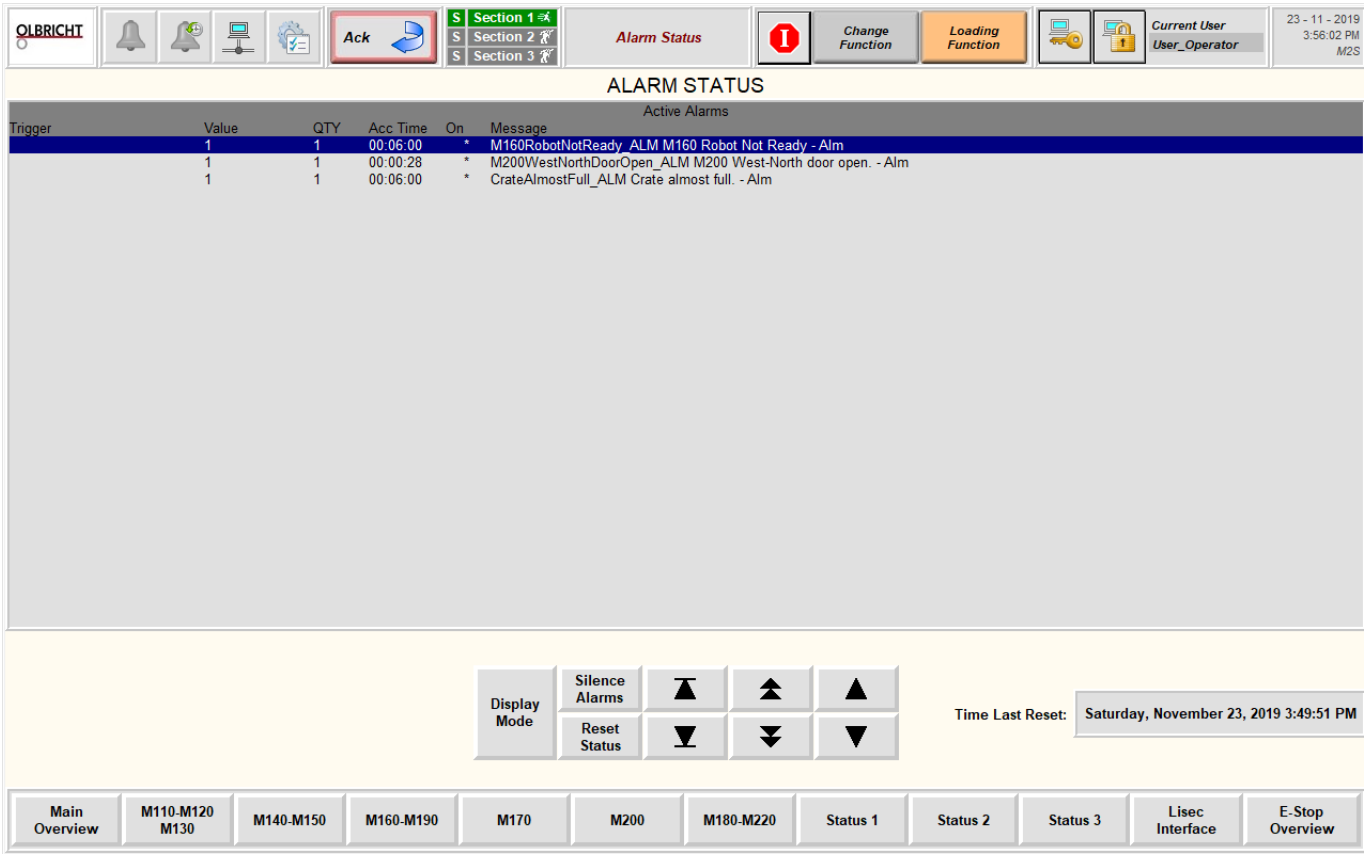
This page pops up when any new alarms arrive and will stay on screen until it is closed or acknowledged. It's contents are the same as the window. After closing the pop up all of the information on that windows can be accessed on the Active Alarms page.



2.3.3.1.3 Alarm Status Page

This page can be accessed by the `Alarm Status` button on both Active Alarms Page or Active Alarms Pop-up. This page contains detailed information about Alarms. This page has three different modes that can be chosen. `Display Mode` can be changed by pressing the `Display Mode` button on the Alarm Status page. Alarm status page contains the following information:

- Quantity of the how many times alarm is triggered
- Accumulated time of the Alarmed state
- If On field has asterisks (*) it means that alarm is still active
- Alarm Message



2.3.3.1.3.1 Active Alarms

This mode shows currently active alarms. Alarms will be the same as Active Alarms, but it contains more information about the alarm.

2.3.3.1.3.2 Past Alarms

This mode shows acknowledged alarms. Alarms will be the same as Alarm History, but it contains more information about the alarm.

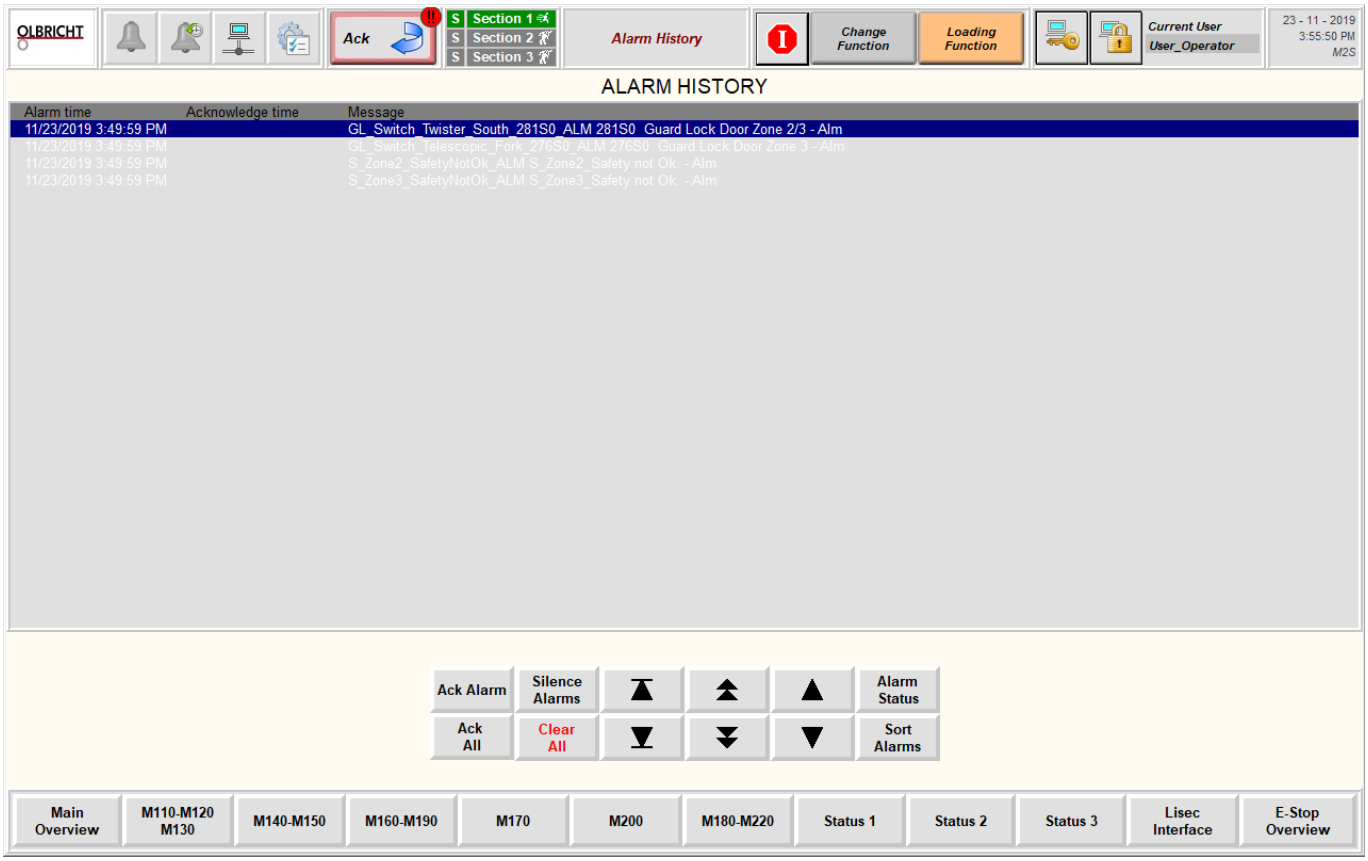
2.3.3.1.3.3 All Alarms

This mode shows all of the defined alarms with total accumulated times and quantities.

2.3.3.1.4 Alarm History Page

This page shows all of the past alarms up to 10000 alarms with alarm and acknowledged times.

Active History Page can be accessed by pressing the `Bell Icon with little clock` right side of the Active Alarms button.



2.3.3.2 Administrator Page

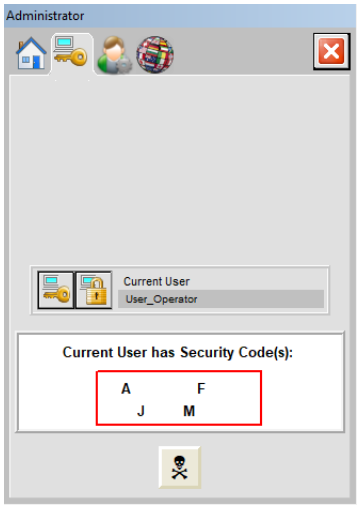
The administrator page contains 4 tabs.

2.3.3.2.1 About Tab

The About tab contains our internal project number and contact information.

2.3.3.2.2 User Access Tab

This tab has user login/logout faceplate and defined Security Codes for currently logged in user.
If the user has required Security Code, the HMI application can be shut down from this tab.



2.3.3.2.3 User Management Tab

A User with the required Security Code manages other users from this tab. Each defined group on FactoryTalk Directory has its Security Codes. By adding or removing users to/from groups, accounts will inherit the groups Security Codes. By default, the only user with the permission to change steps of the sequencers is the `Engineers` group, which only contains the `user_Engineer` account.

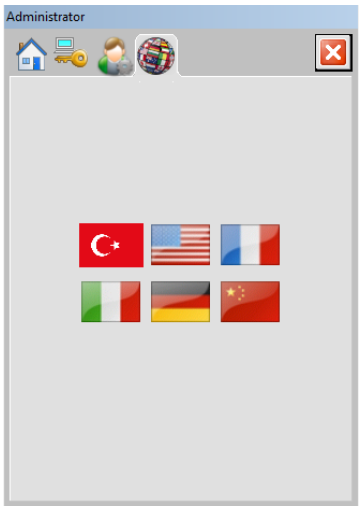
Manager account can easily add/remove, enable/disable, add users to group, or remove and change properties of other HMI users from the project from this page.

Throughout the application, user code `D` used for engineering and user code `F` used for operator accesses. With the appropriately named `HMI_Engineering` and `HMI_Operator` groups respectively.

Detailed information about user management can be found in the User Management section of this document. Also for extra information about FactoryTalk Security please consult `FactoryTalk Security System Configuration Guide` document published by Rockwell Automation with document number FTSEC-QS001N-EN-E.

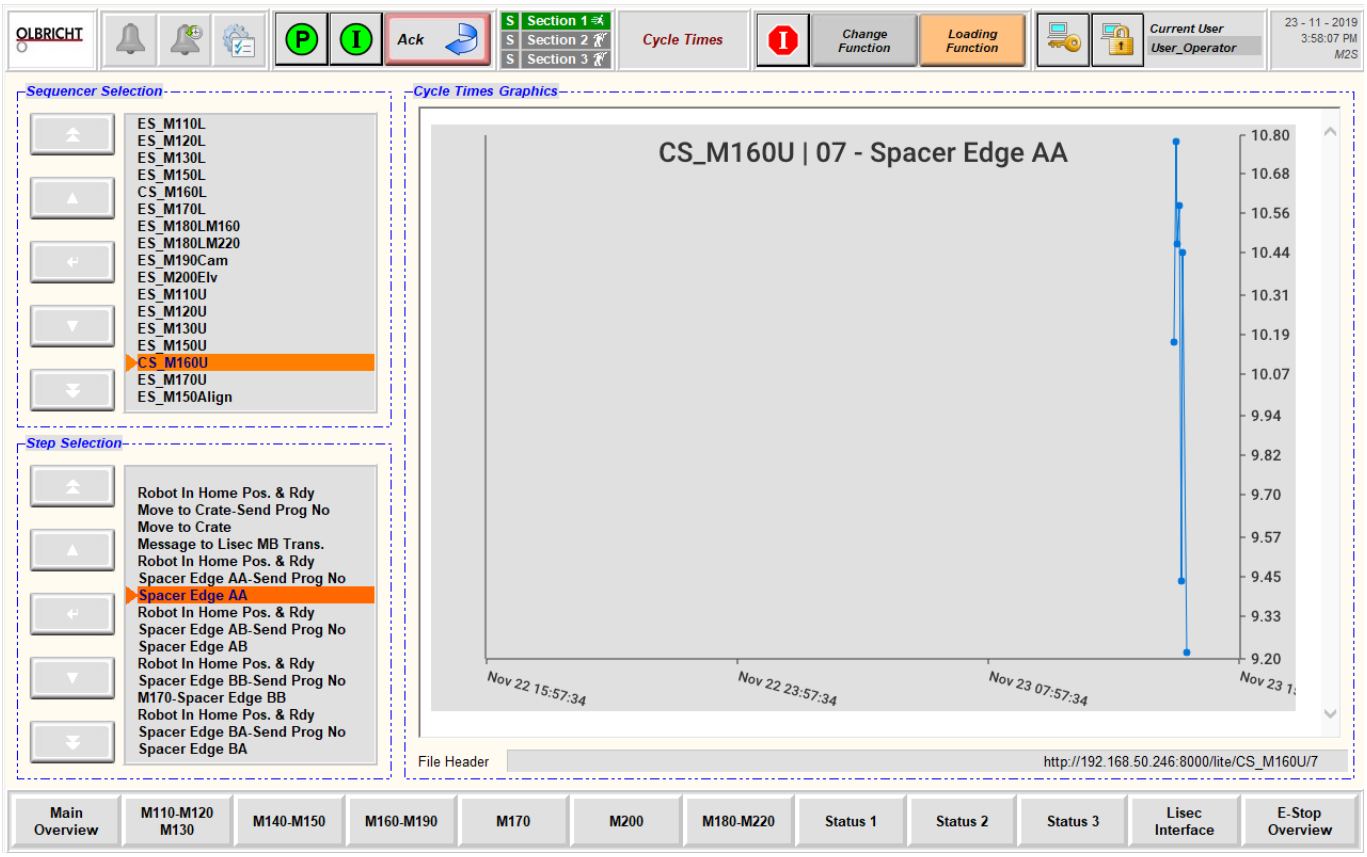
2.3.3.2.4 Language Selection Tab

On this tab, there are 6 predefined language buttons for HMI. There is an only English version of the project is available. But by adding the required translations to the provided HMI project, any new languages can be added if necessary.



2.3.3.3 Cycle Times

This page can be accessed using the Cycle Times button on the Main Overview page. On the top left side of the page, the user must select the sequencer he/she wants to investigate. Doing so will load the steps of that sequencer to the list on the bottom left of the screen. Selecting any step from that list will load a graph showing measurement for that step for the last 7 days.



2.3.3.4 Sequencers

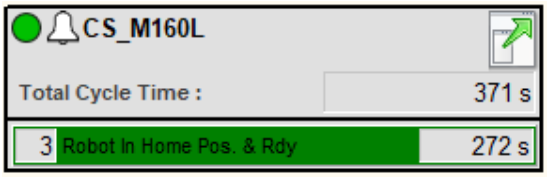
Given any point in time, there are 10 sequencers active in the M2S. Each one of them is responsible for only one equipment. Some pieces of equipment have two sequencers running depending on the selected function of the M2S. Sequencers follow a naming scheme to make it easier to understand which sequencers control which equipment and on which mode.

2.3.3.4.1 Sequencers in M2S

Prefix	Equipment Name	Depending	Sequencer Name
Equipment	M110	Loading	ES_M110L
Equipment	M110	Unloading	ES_M110U
Equipment	M120	Loading	ES_M120L
Equipment	M120	Unloading	ES_M120U
Equipment	M130	Loading	ES_M130L
Equipment	M130	Unloading	ES_M130U
Equipment	M150	Loading	ES_M150L
Equipment	M150	Unloading	ES_M150U
Control	M160	Loading	CS_M160L
Control	M160	Unloading	CS_M160L
Equipment	M170	Loading	ES_M170L
Equipment	M170	Unloading	ES_M170U
Equipment	M180	Active Area (M160)	ES_M180M160
Equipment	M180	Passive Area (M220)	ES_M180M220
Equipment	M190	Camera	ES_M190Cam
Equipment	M200	Elevator	ES_M200Elv

2.3.3.4.2 Faceplates

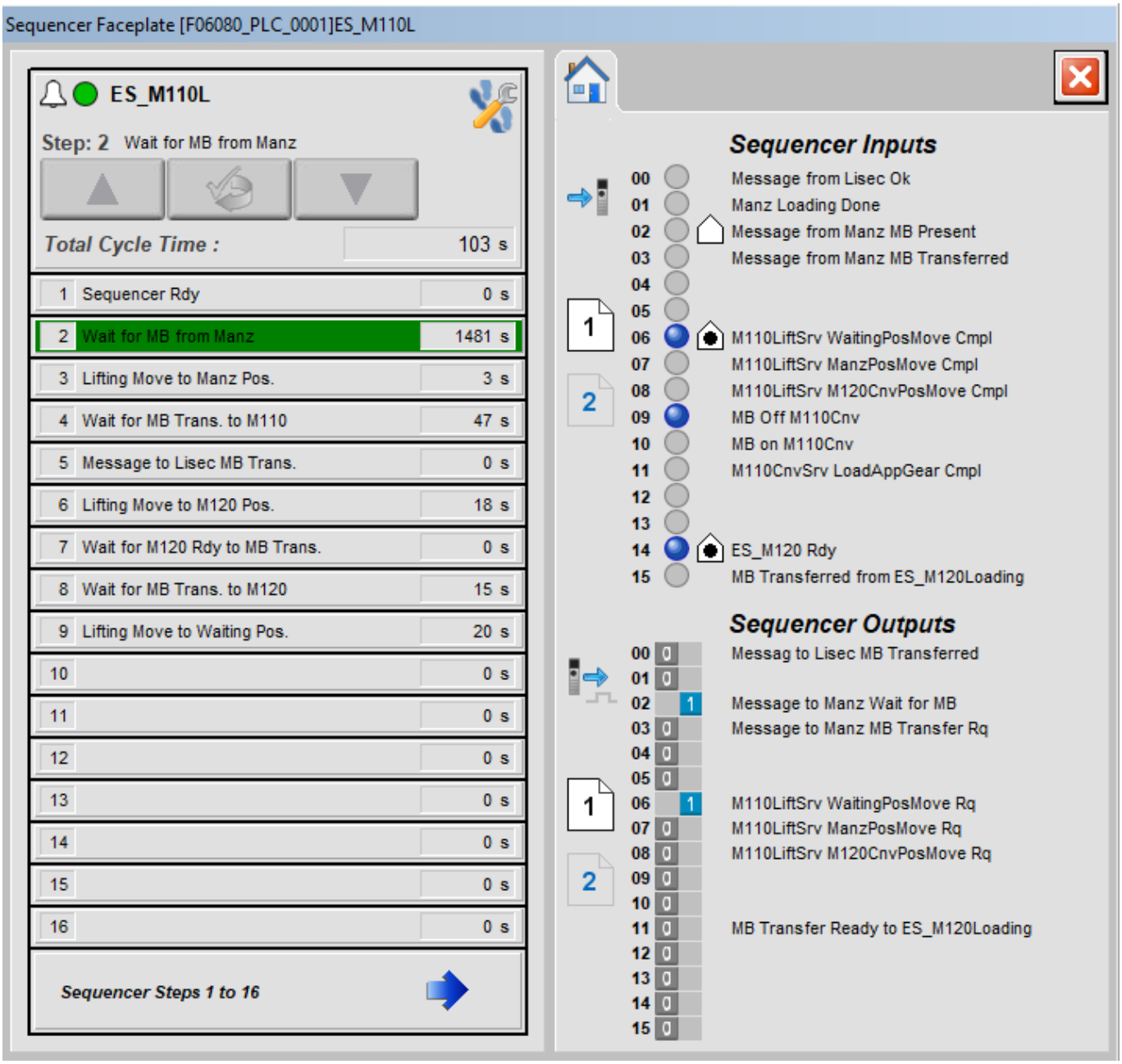
2.3.3.4.2.1 Small Sequencer Faceplate



Here is the small faceplate and shows only information needed to judge if everything is in order or not in a glance. On the top right side of the faceplate, there is `Maximize Button`. Pressing it will open up the `Extended Sequencer Faceplate`. Under the `Maximize Button`, there is a `Total Cycle Time` counter, which counts the seconds passed since this sequencer finished the last cycle and started a new one.
Under `Total Cycle Time`, there is a current step indicator. It consists of 3 horizontal parts.

- The first one contains a number indicating which step the sequencer is on.
- The second one contains a description for the currently active step, also will change colors to `Green` `Gray` or `Red` depending on if the sequencer is on `Running` `Stopped` or `Error` respectively.
- The third one contains a timer resets when the current step is started and indicates time spend on this step.

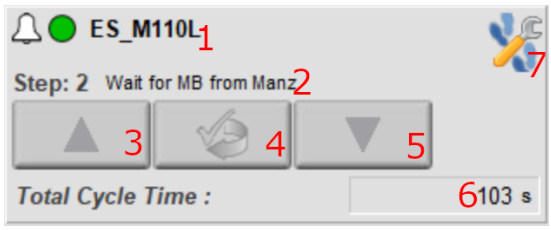
2.3.3.4.2.2 Extended Sequencer Faceplate



Extended Sequencer Faceplate consists of 4 different parts.

Sequencer Current Status

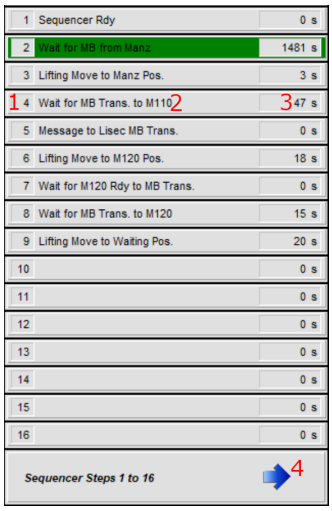
The top left side of the faceplate contains sequencer name, current step description, total cycle time, and buttons to advance sequencer one step forward, one step back, reset to initial state or open the editor for the current sequencer.



1. Sequencer Name
2. Current Step Number and Description
3. Move current step one back
4. Reset sequencer to initial state
5. Move the current step forward
6. Total Cycle Time, since the initial start of this cycle
7. Button to open Sequencer Editor Faceplate

Sequencer Steps

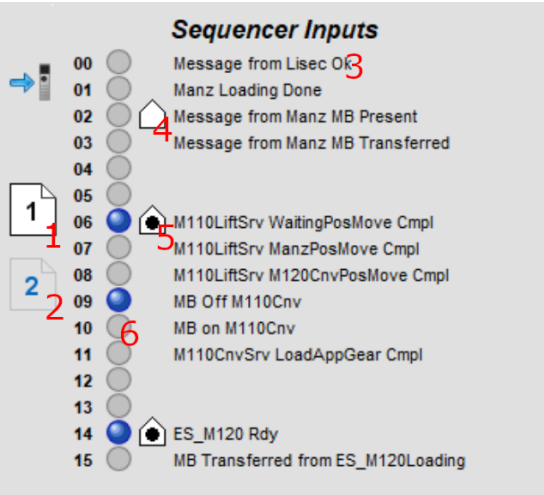
The bottom left side, containing sequencer steps in this sequencer with how much time spend on those steps on the last cycle. Since there is not enough room for include all 32 steps in one screen, there is pagination included in this part and can be controlled by the bottom-most button with a blue arrow on it.



1. Sequencer step numbers
2. Sequencer step descriptions
3. Cycle time spend on this step, last time it runs
4. Next/previous page button to cycle between 1 to 16 and 17 to 32 step numbers.

Sequencer Current Step Inputs

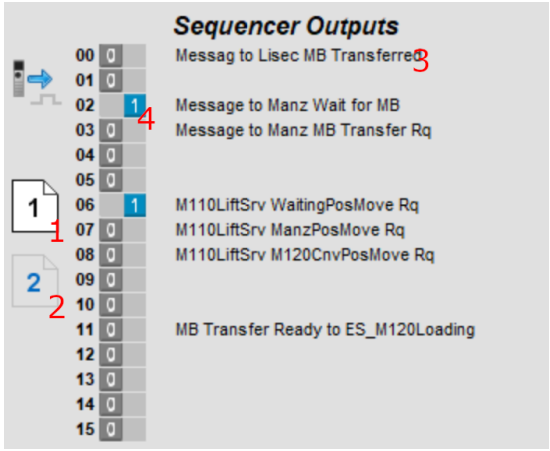
The top right side of the faceplate contains input descriptions, and indicators for expected inputs, status lights for all defined inputs, and expected and currently active inputs. Since there is not enough room for include all 32 inputs in one screen, there is pagination included in this part and can be controlled by Page icons with the 1 and 2 written on them.



1. Button for navigating to page 1
2. Button for navigating to page 2
3. Input descriptions
4. Expected input indicator
5. Expected and active input indicator
6. Input state indicator

Sequencer Current Step Outputs

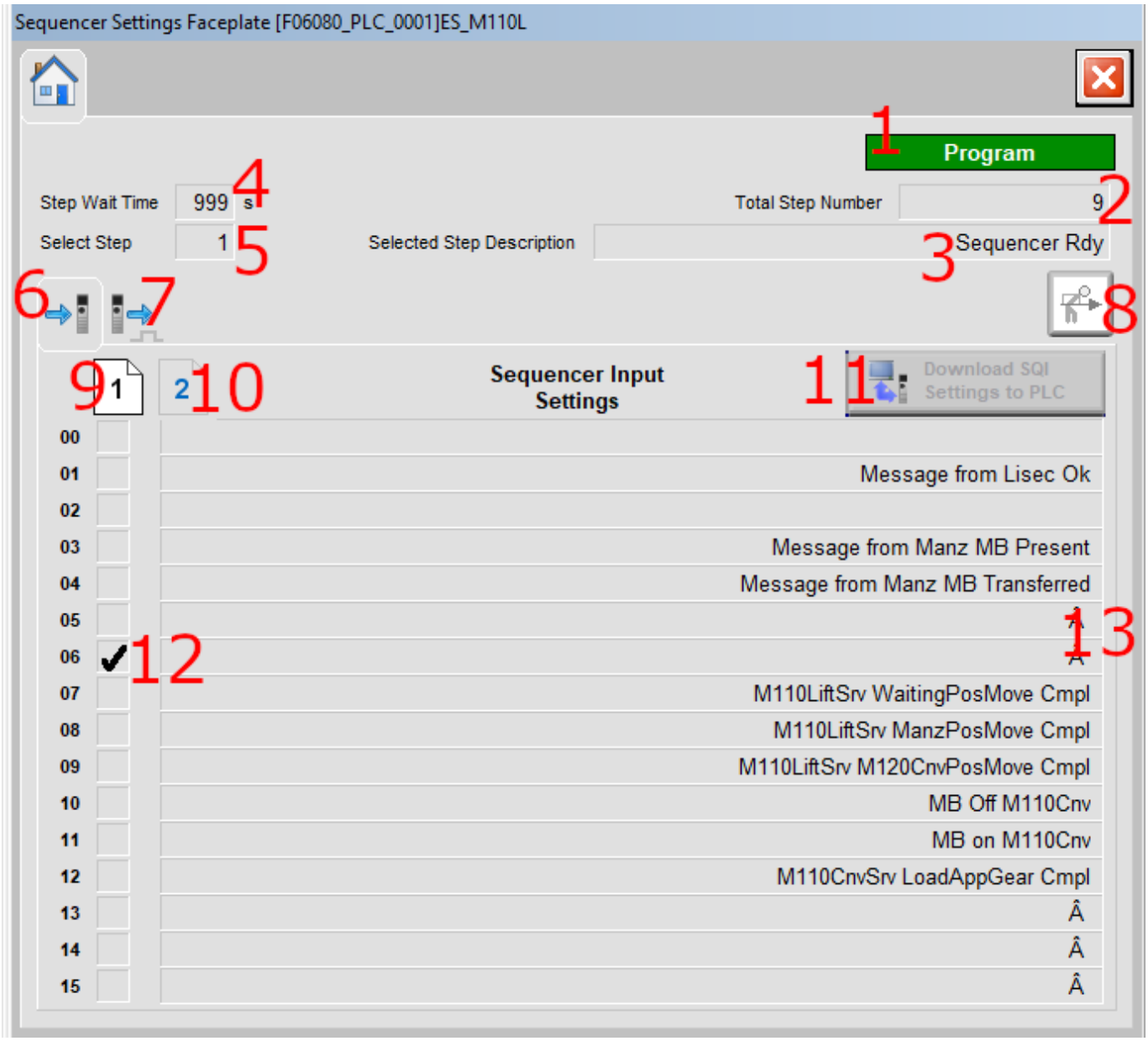
The bottom right side of the faceplate contains output descriptions and indicators for currently active outputs. Since there is not enough room for include all 32 outputs in one screen, there is pagination included in this part and can be controlled by Page icons with the 1 and 2 written on them.

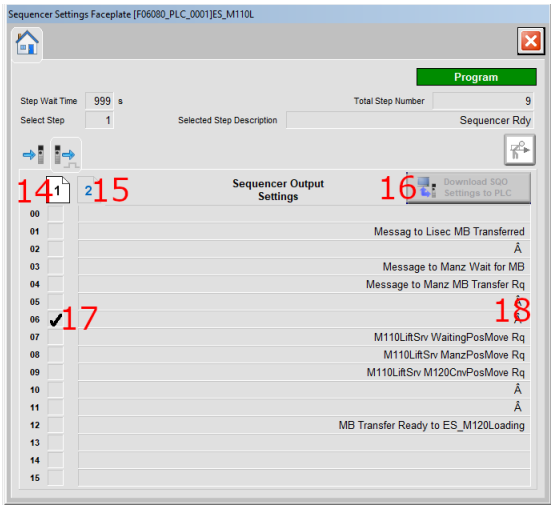


1. Button for navigating to page 1
2. Button for navigating to page 2
3. Output descriptions
4. Output state indicator

2.3.3.4.2.3 Sequencer Editor Faceplate

With the sufficient access permissions on User, sequencer steps descriptions, expected inputs, and required outputs can be changed on HMI. Any changes made here are not applied until the user pressed the `Download SQI Settings to PLC` or `Download SQO Settings to PLC` buttons.

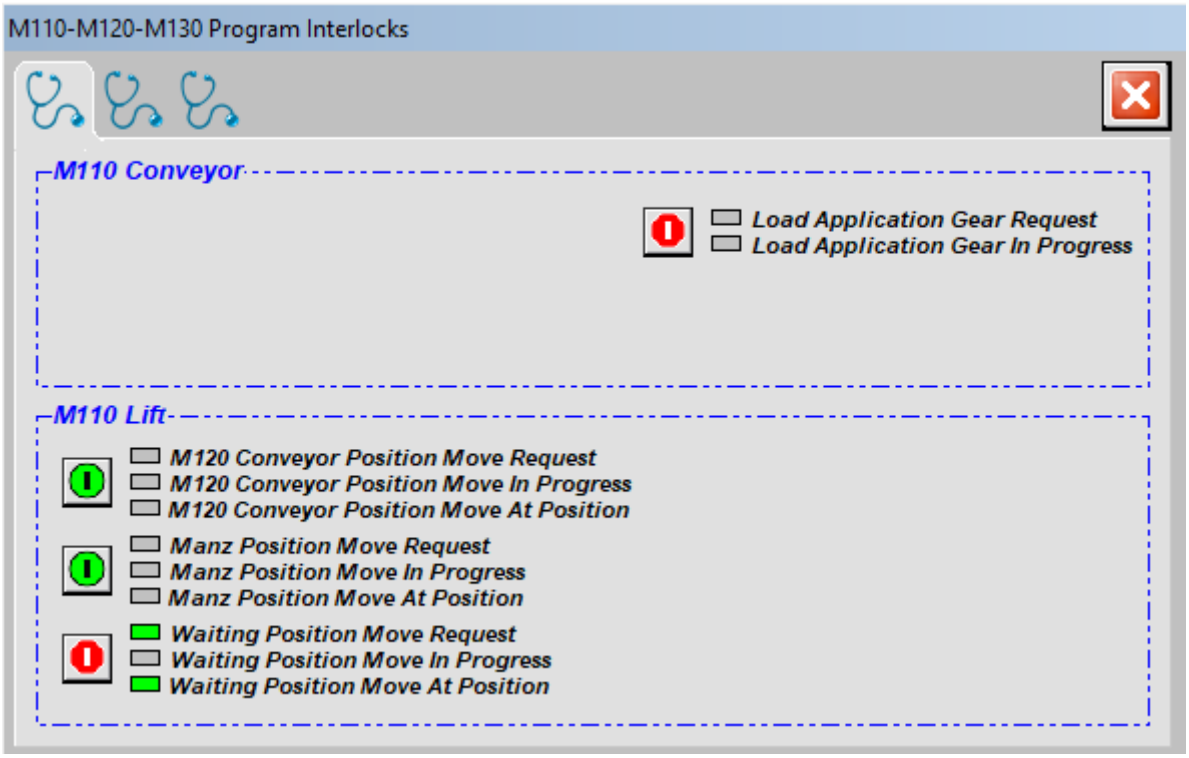




1. Current run state of the sequencer
2. The total step count on the sequencer
3. Selected steps description
4. Alarm time for a given step, if more than this time is spent on this step, the sequencer will go to an error state and will wait for acknowledge from the operator
5. Step selection input
6. Inputs tab
7. Outputs tab
8. Enable/Disable single step mode
9. Button for navigating to page 1 of Inputs
10. Button for navigating to page 2 of Inputs
11. Saving input changes to PLC
12. Checkbox to indicate in this step sequencer waits for this input
13. Input descriptions
14. Button for navigating to page 1 of Outputs
15. Button for navigating to page 2 of Outputs
16. Saving output changes to PLC
17. Checkbox to indicate in this step sequencer provides this output
18. Output descriptions

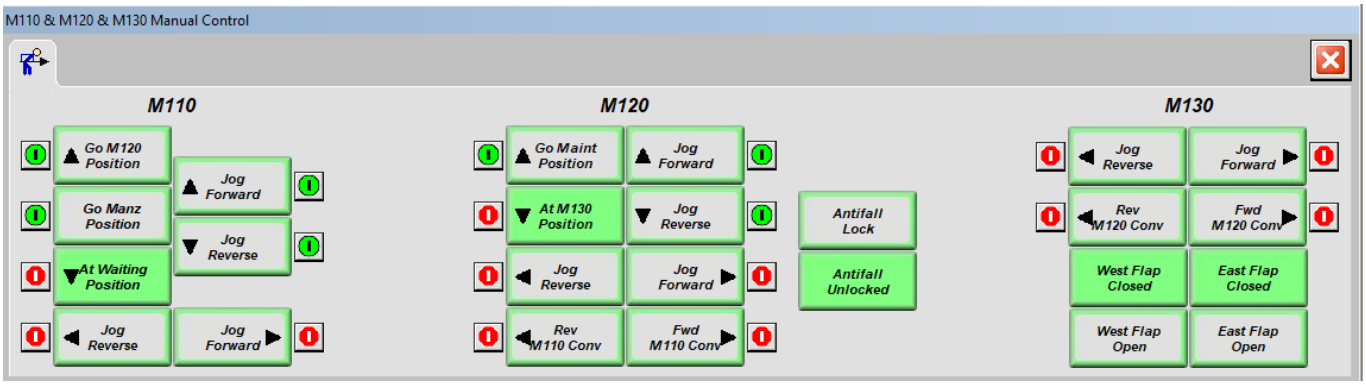
2.3.3.5 Program Interlocks

Program Interlocks page contains all of the interlocks for program defined movements of the equipment on the page.



2.3.3.6 Operator Mode Controls

The operator Control page contains all of the `Operator Mode Actions` described in the Equipments section of this document with `Red` or `Green` Interlock icons with the action buttons. The interlock icon can be pressed to open Interlock Pop-up containing defined interlocks for that move. But on a glance, if the Interlock Icon is green and that section is Operator Mode selected move can be executed.

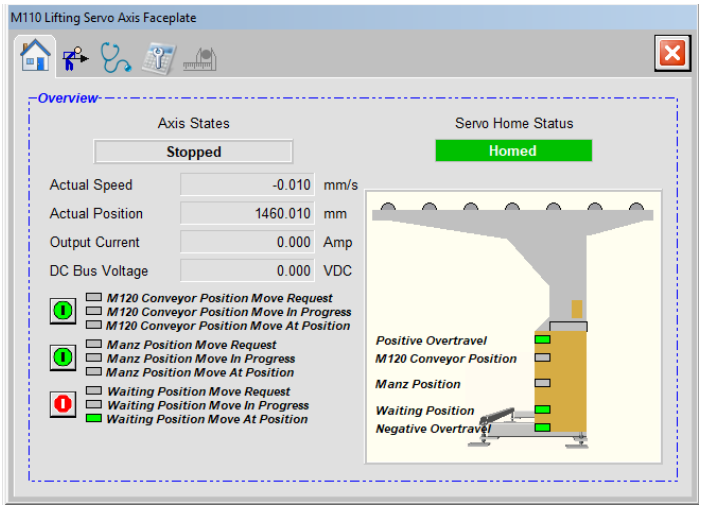


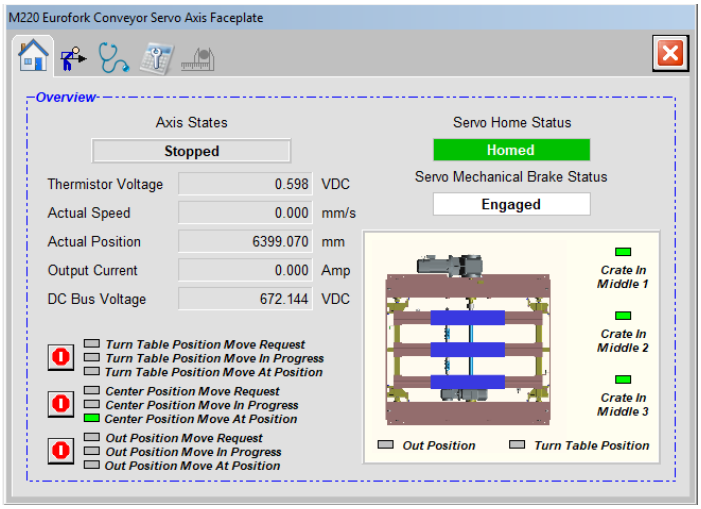
2.3.3.7 Advanced Axis Control Options

Advanced axis control pages include all of the essential settings and information in case of maintenance. It consists of multiple tabs and pages for manual operations and diagnostics and contains any indicators for sensors related to that axis.

2.3.3.7.1 Overview Tab

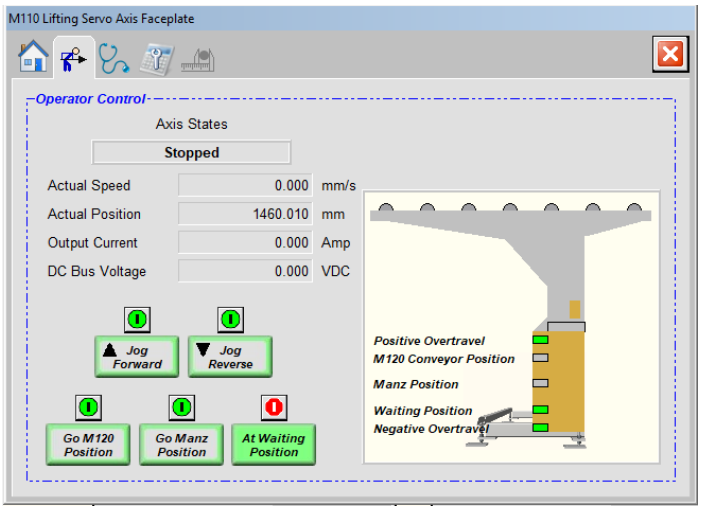
The main menu for AAC contains Axis State, Axis Home Status(if applicable), and live measurements from the drive, which includes speed, position current, and DC Bus voltage. It Also contains Interlock states for program defined moves on that axis.

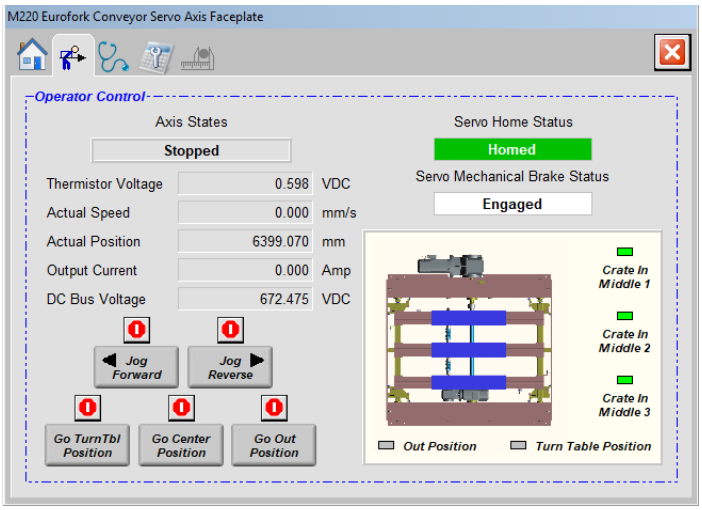




2.3.3.7.2 Operator Control Tab

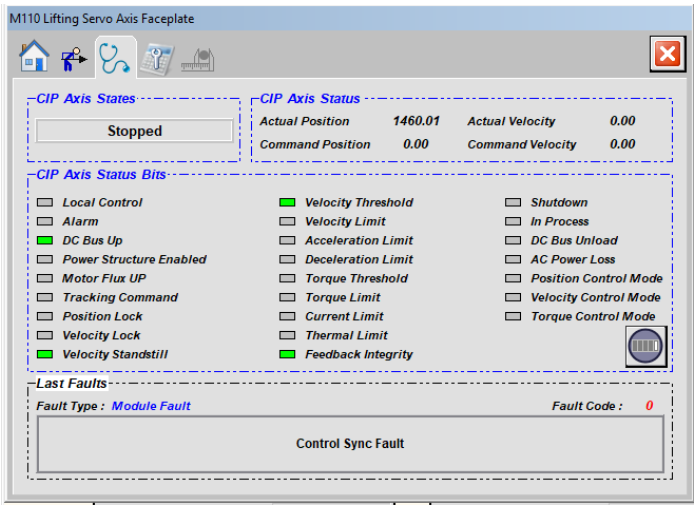
The operator control tab contains the same diagnostics information with an overview tab with the actions for all the defined Operator Moves. If Interlock Icon belonging the desired action is green, and that section is in the operator mode, then it is executable.

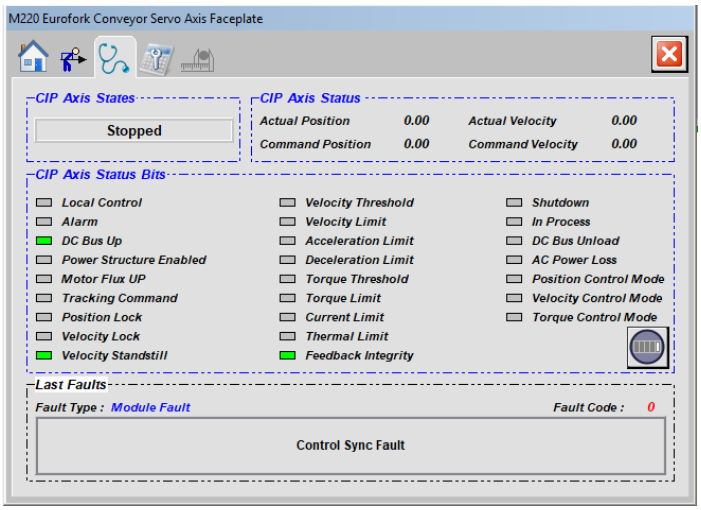




2.3.3.7.3 Diagnostics and Status Tab

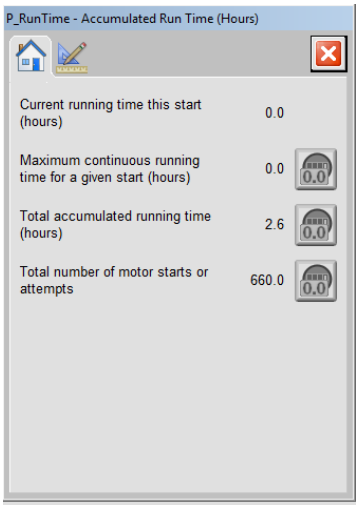
The Diagnostics tab contains information directly acquired from the drive for detailed troubleshooting purposes. It contains Axis State, Axis Status, Status Bits from the drive, accumulated run time counters, and Fault information details for last recorded fault.





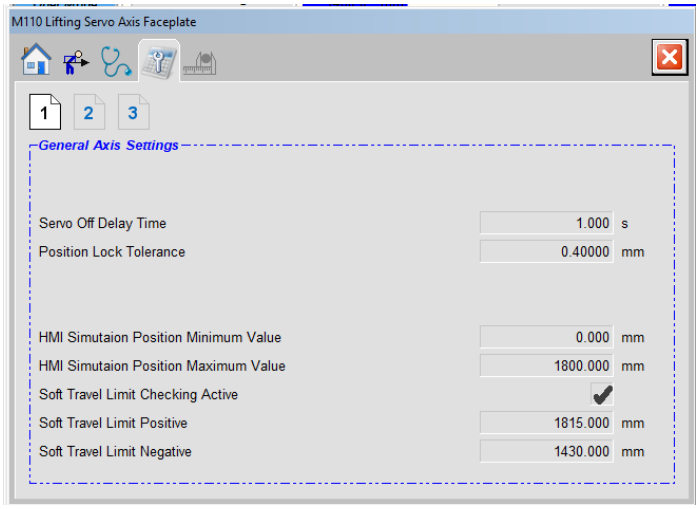
2.3.3.7.3.1 Accumulated Run Time Counters

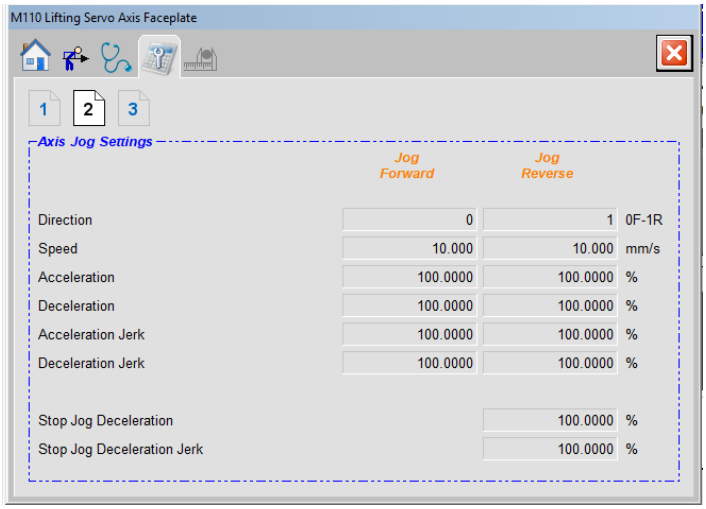
Accumulated Run Times page contains run times for the given motor.

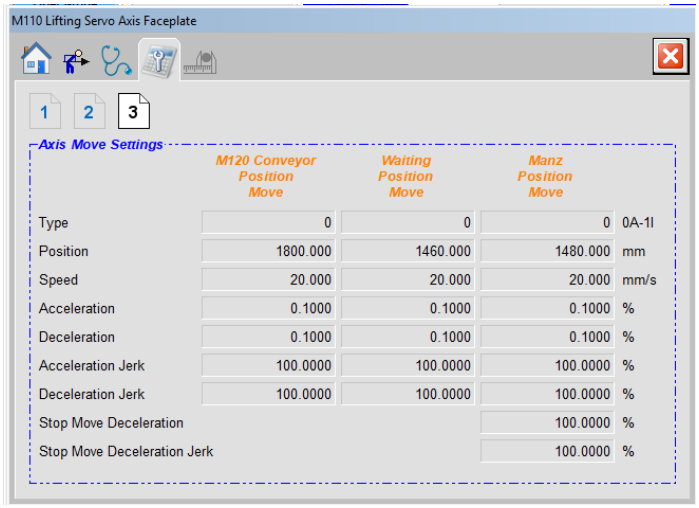


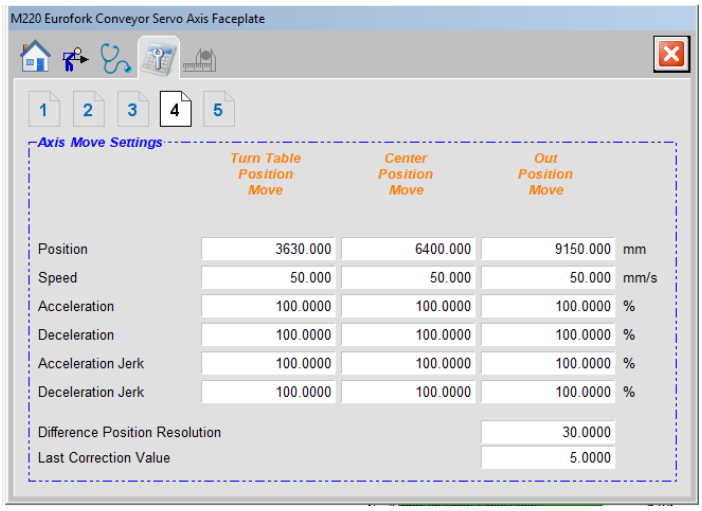
2.3.3.7.4 Axis Settings Tab

In this tab, users with appropriate Security Codes can change any settings related to that drive. Without needing to connect, re-program, or install any software.



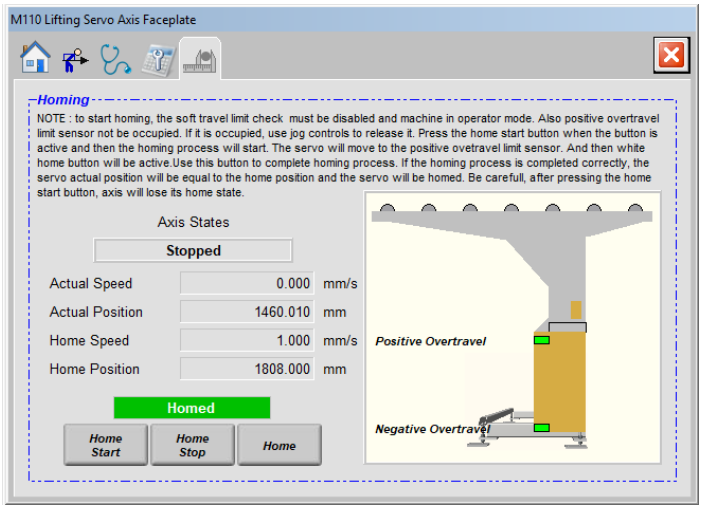


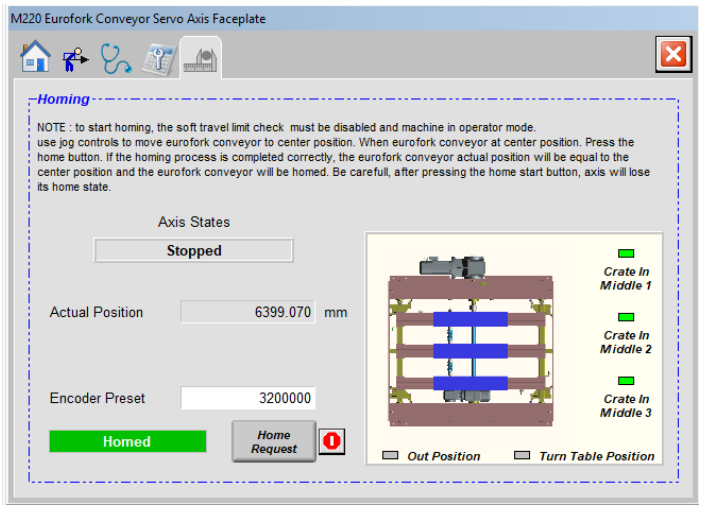



M220 Eurofork Conveyor Servo Axis Faceplate
1
2
3
4
5
Axis Move Settings
Turn Table Position Move
Center Position Move
Out Position Move
Position 3630.000 6400.000 9150.000 mm
Speed 50.000 50.000 50.000 mm/s
Acceleration 100.0000 100.0000 100.0000 %
Deceleration 100.0000 100.0000 100.0000 %
Acceleration Jerk 100.0000 100.0000 100.0000 %
Deceleration Jerk 100.0000 100.0000 100.0000 %
Difference Position Resolution 30.0000
Last Correction Value 5.0000

2.3.3.7.5 Homing Tab

In this tab, you can find the homing instructions and Home button for that axis. Every equipment can have a different homing process, but it is described in detail in Home tab descriptions.

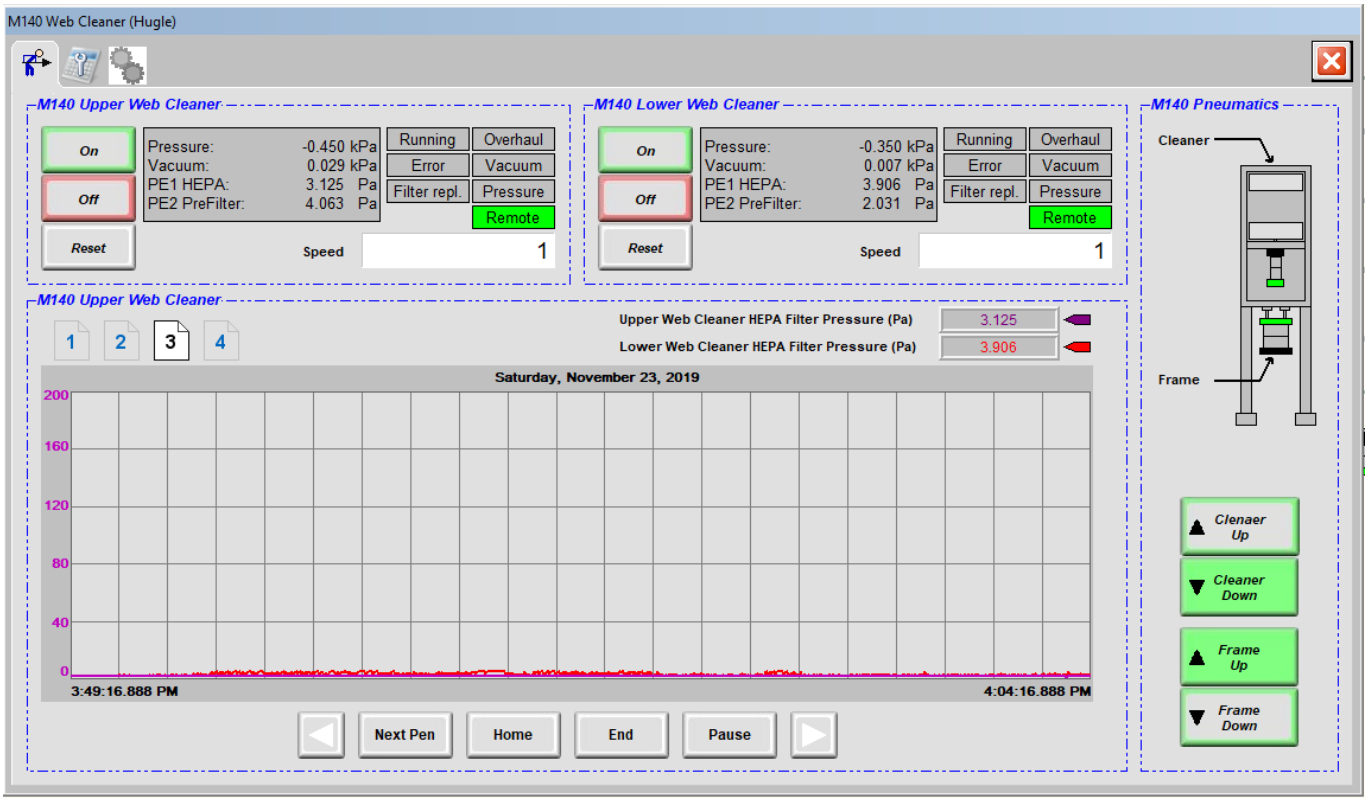




2.3.3.8 Hugle

On this page, the operator can manually control the pneumatics controlling the Hugle position and Hugle itself. Upper and Lower Hugles are separately controlled. Also, there are 4 different charts for analog values for diagnostics.

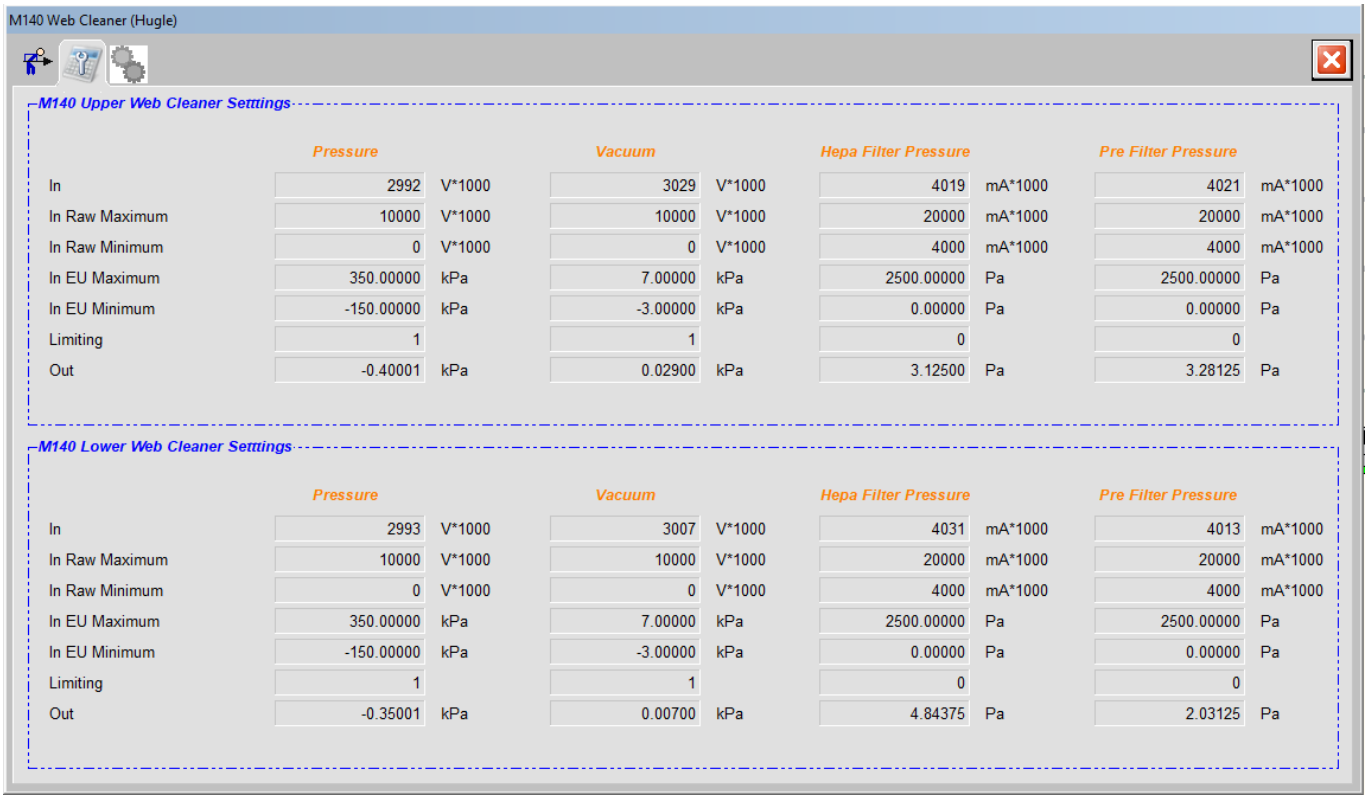
2.3.3.8.1 Hugle Overview Tab



1. Turn on Upper Hugle at Set Speed
2. Turn of Upper Hugle completely
3. Reset any errors on Upper Hugle
4. Set Speed for Upper Hugle
5. Upper Hugle analog feedback values
6. Upper Hugle error and status bits
7. Turn on Lower Hugle at Set Speed
8. Turn of Lower Hugle completely
9. Reset any errors on Lower Hugle
10. Set Speed for Lower Hugle
11. Lower Hugle analog feedback values
12. Lower Hugle error and status bits
13. Move Cleaner Up
14. Move Cleaner Down
15. Move Frame Up
16. Move Frame Down

2.3.3.8.2 Hugle Analog Scaling Settings Tab

Any scaling settings for analog values sent by Hugle can be set up and changed anytime.



M140 Upper Web Cleaner Settings

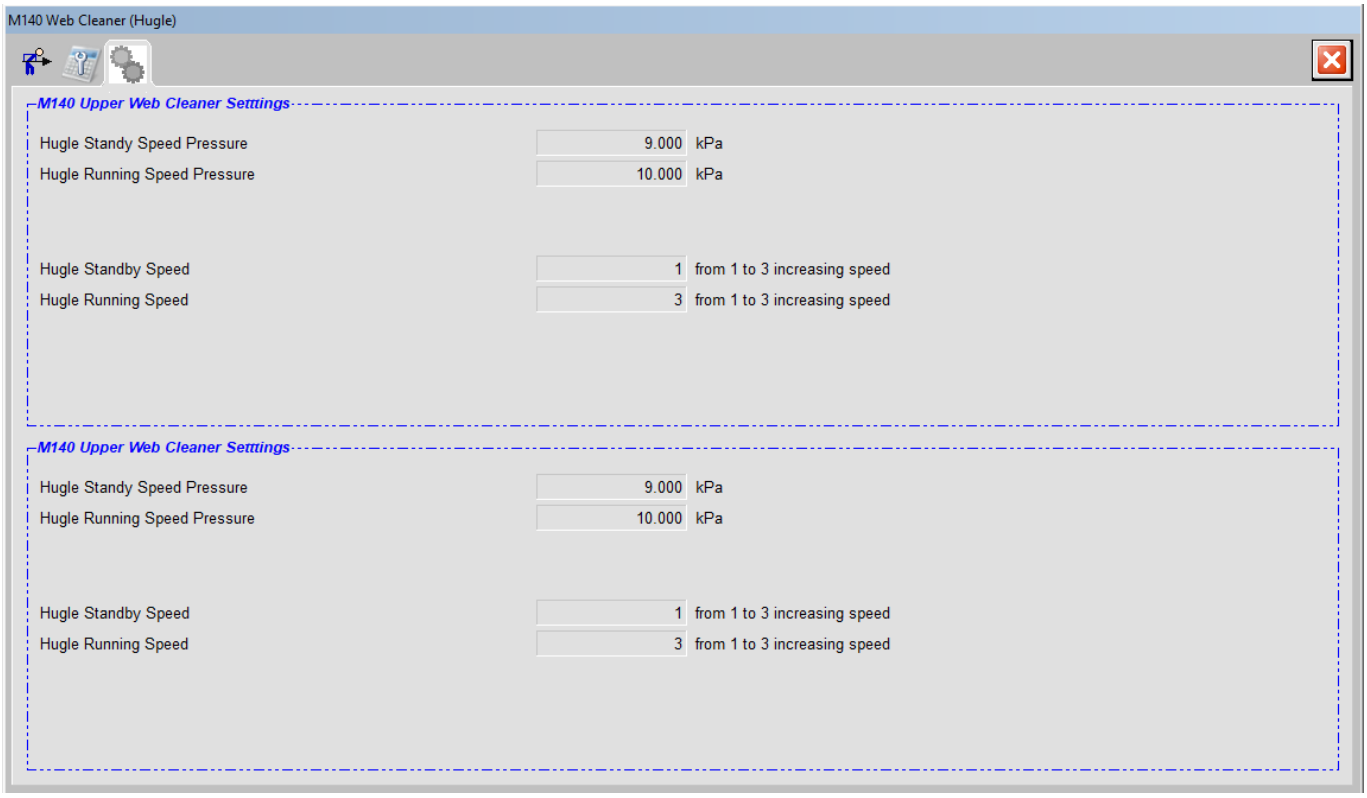
	Pressure		Vacuum		Hepa Filter Pressure		Pre Filter Pressure	
In	2992	V*1000	3029	V*1000	4019	mA*1000	4021	mA*1000
In Raw Maximum	10000	V*1000	10000	V*1000	20000	mA*1000	20000	mA*1000
In Raw Minimum	0	V*1000	0	V*1000	4000	mA*1000	4000	mA*1000
In EU Maximum	350.00000	kPa	7.00000	kPa	2500.00000	Pa	2500.00000	Pa
In EU Minimum	-150.00000	kPa	-3.00000	kPa	0.00000	Pa	0.00000	Pa
Limiting	1		1		0		0	
Out	-0.40001	kPa	0.02900	kPa	3.12500	Pa	3.28125	Pa

M140 Lower Web Cleaner Settings

	Pressure		Vacuum		Hepa Filter Pressure		Pre Filter Pressure	
In	2993	V*1000	3007	V*1000	4031	mA*1000	4013	mA*1000
In Raw Maximum	10000	V*1000	10000	V*1000	20000	mA*1000	20000	mA*1000
In Raw Minimum	0	V*1000	0	V*1000	4000	mA*1000	4000	mA*1000
In EU Maximum	350.00000	kPa	7.00000	kPa	2500.00000	Pa	2500.00000	Pa
In EU Minimum	-150.00000	kPa	-3.00000	kPa	0.00000	Pa	0.00000	Pa
Limiting	1		1		0		0	
Out	-0.35001	kPa	0.00700	kPa	4.84375	Pa	2.03125	Pa

2.3.3.8.3 Hugle Automatic Run Settings Tab

Any settings related to how Hugle should be running can be changed on this tab.

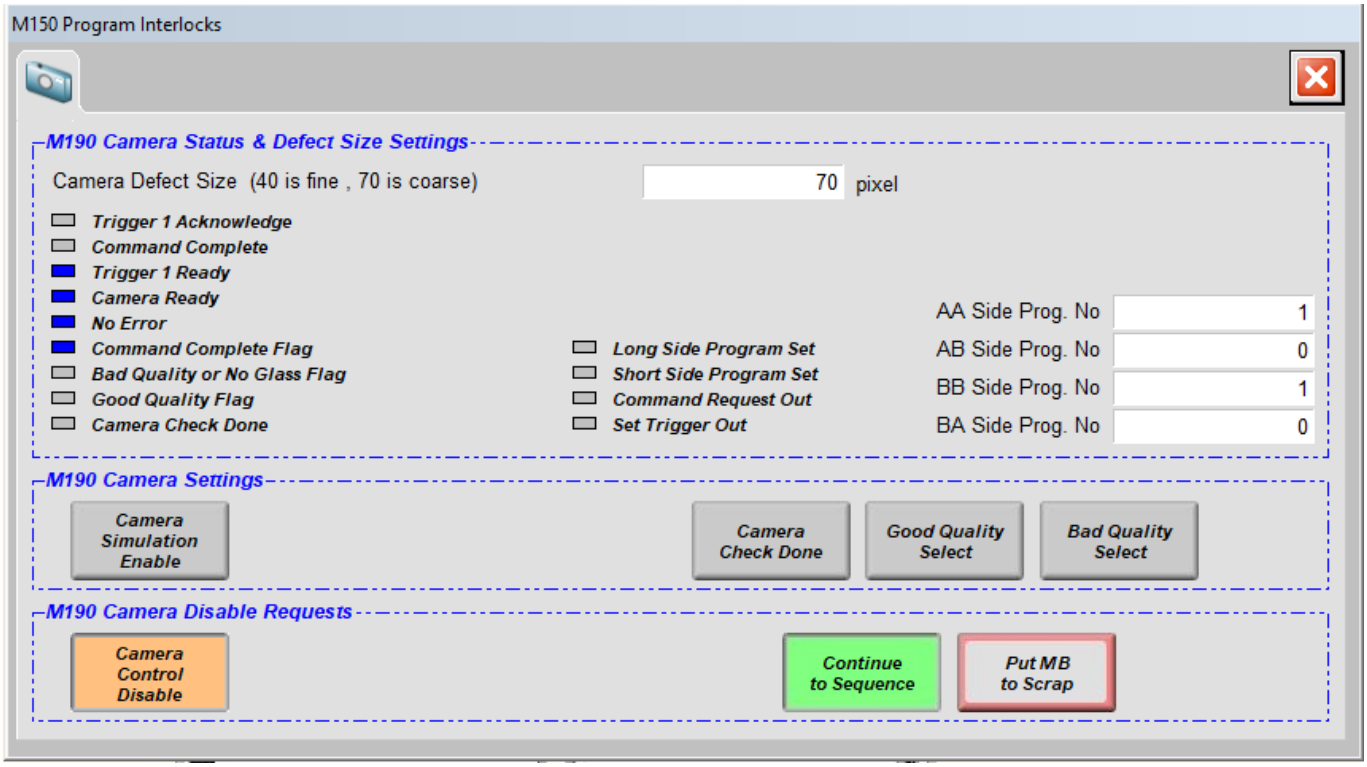


1. If current feedback pressure is lower then this value and Stand-by speed are set, Program assumes Hugle is on Stand-by speed.
2. If current feedback pressure is higher then this value and Running speed are set, Program assumes Hughle is on Running speed.

2.3.3.9 Camera Inspection Controls

In this page operator can manually control the camera defect detection settings and which program to run while checking each side of the motherboard. Also, indicator bits are containing all of the information transferred between the Camera and Program.

Users with the appropriate security codes can see `M190 Camera Settings` and `M190 Camera Disable Requests` sub-menus.



1. Horizontal defect detection size of the camera in pixels. Any defect smaller than this will pass.
2. Program numbers to run in each edge of the motherboard
3. If selected, camera simulation is enabled, and after scanning done, Program will simulate selected results from the right-hand side of the screen.
    - If selected Camera Check Done bit will be simulated by PLC
    - If selected Camera Result will be simulated as `Good` by PLC
    - If selected Camera Result will be simulated as `Bad` by PLC
4. If selected, the camera is disabled, and the robot will not execute camera scan motions. The program will simulate the selected result from the right-hand side of the screen.
    - If selected Camera Result will be simulated as `Good` by PLC
    - If selected Camera Result will be simulated as `Bad` by PLC

2.3.3.10 Manual Barcode Entry Page

This page will show up when the `Manual Barcode Entry` button on M160-190 Page pressed. If any failure happens while reading the barcode, the `Manual Barcode Entering` field will be available for edit. After entering the barcode, the operator can press the enter button to continue the process.

Also, URL settings for barcodes can be changed here. Barcode URL created dynamically by Program using these values with the following formula. Then send it to the local browser for showing the barcode. If something related to the FTP server etc. changed on the remote HMI, these parameters also maybe need to change.

```
BrowserAddress = FileHeader + FolderPath + BarcodeImageID
```

2.3.3.11 Robot Status Page

To open up this page you can use Robot Status button on M160-M190 page.

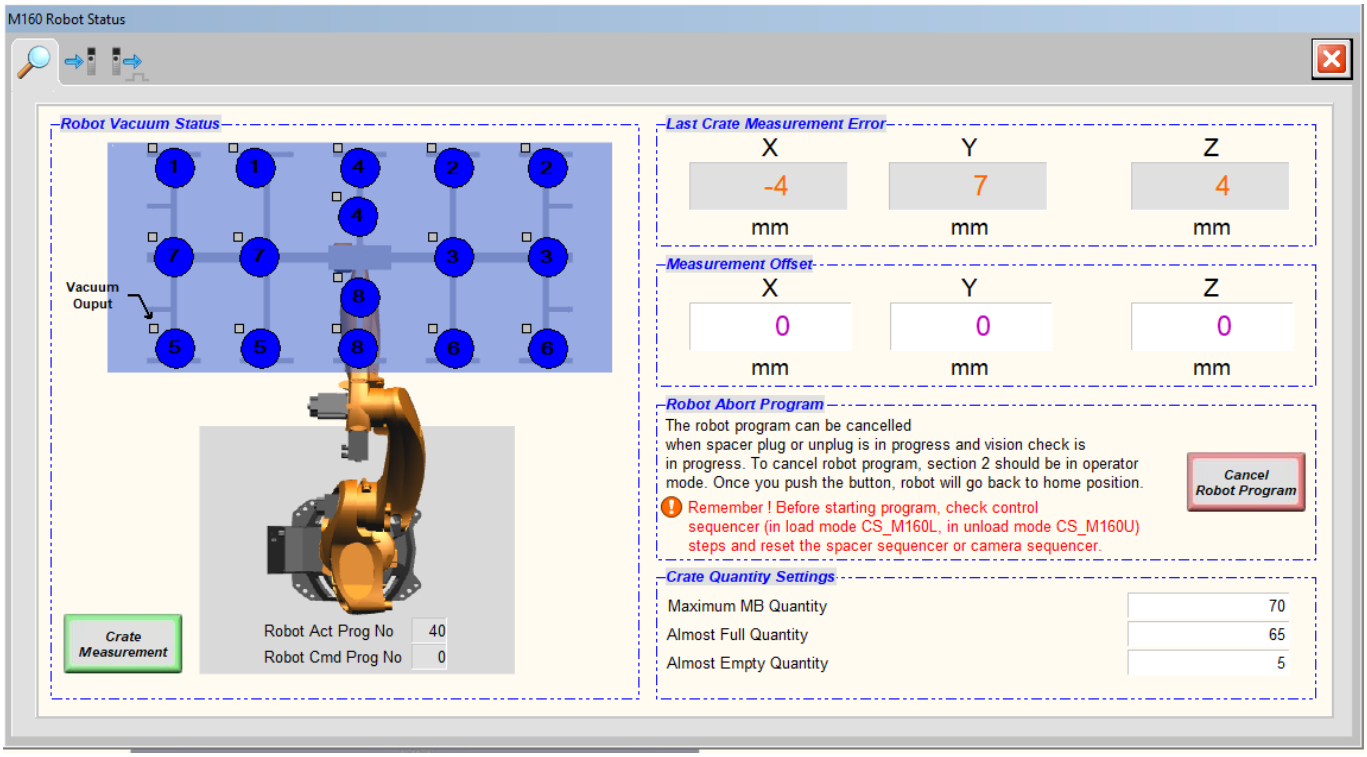
This page contains information directly related to the robot. An operator can easily see some diagnostics information about the robot, and with required security codes, it can change some settings related to the robot.

There are two sets of settings one for offsetting the robot, related to measured crate position another one for changing crate quantity settings.

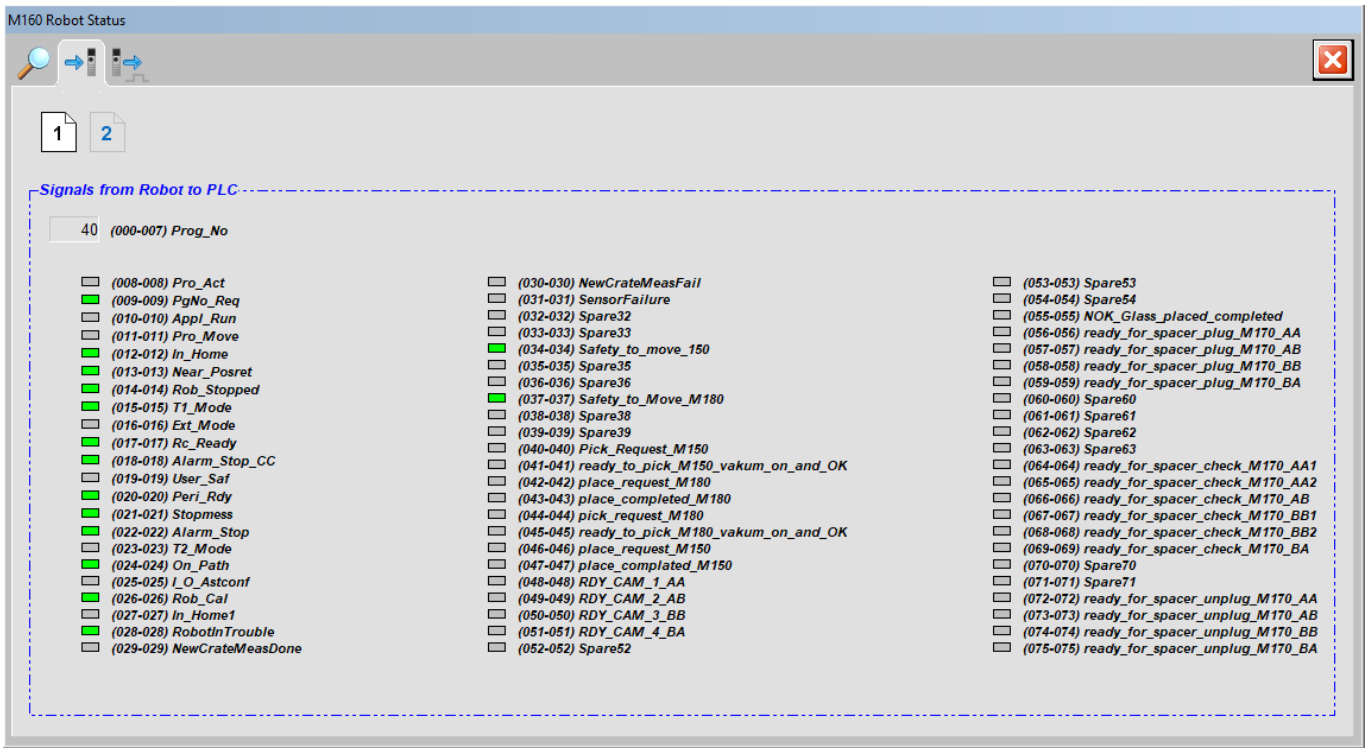
Other than that, there are two buttons to trigger two actions. Both of these are not required to use in normal circumstances.

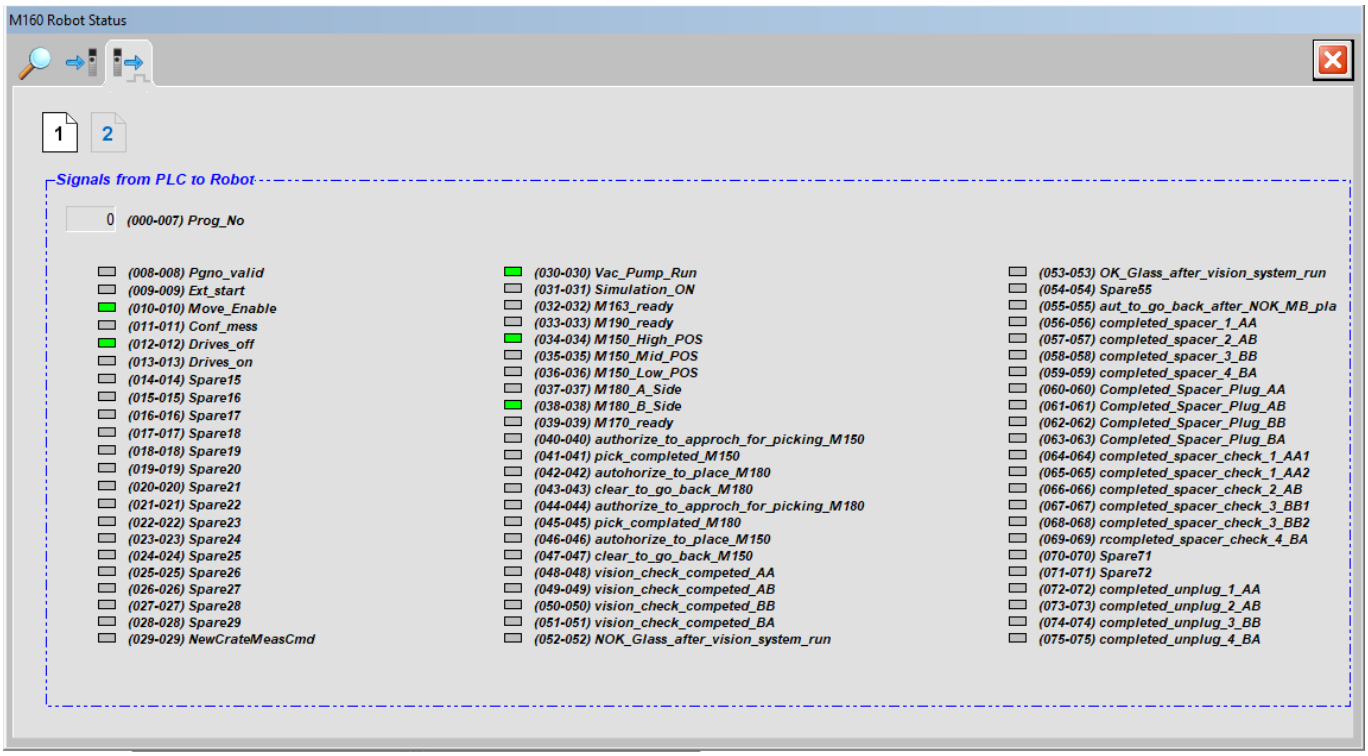
Crate Measurement, commands the robot to measure the crate in the next cycle. The robot will update it's measurement offsets after this process. Do not use this button unless anything wrong with the robot.

Cancel Robot Program, commands the robot to stop in-progress action and go home safely. If the operator thinks anything wrong (breakage, etc.) with the current motherboard handled by the robot, he/she can use this button to send the robot to the home position, then can use Operator Controls to safe disposal of the motherboard.



The other two tabs are solely for diagnostics purposes. You can find all of the communication bits used between program and robot to stay in sync while in operation.

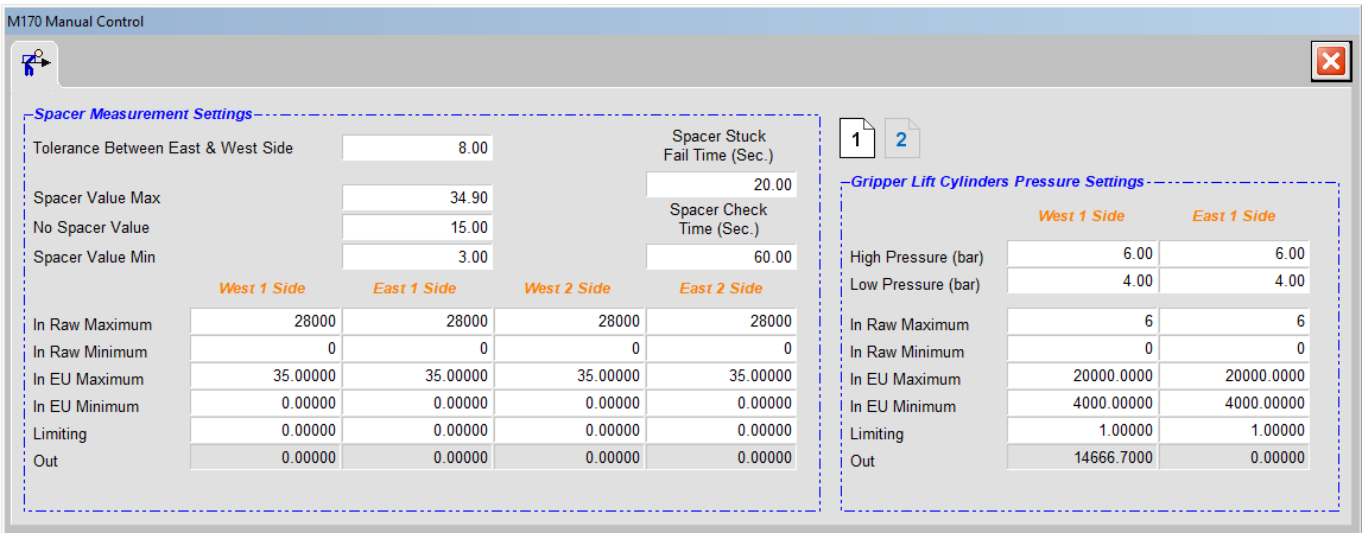

M160 Robot Status
1
2
Signals from Robot to PLC
40 (000-007) Prog_No
(008-008) Pro_Act
(009-009) PgNo_Req
(010-010) Appl_Run
(011-011) Pro_Move
(012-012) In_Home
(013-013) Near_Posret
(014-014) Rob_Stopped
(015-015) T1_Mode
(016-016) Ext_Mode
(017-017) Rc_Ready
(018-018) Alarm_Stop_CC
(019-019) User_Saf
(020-020) Peri_Rdy
(021-021) Stopmess
(022-022) Alarm_Stop
(023-023) T2_Mode
(024-024) On_Path
(025-025) I_O_Astconf
(026-026) Rob_Cal
(027-027) In_Home1
(028-028) RobotInTrouble
(029-029) NewCrateMeasDone
(030-030) NewCrateMeasFail
(031-031) SensorFailure
(032-032) Spare32
(033-033) Spare33
(034-034) Safety_to_move_150
(035-035) Spare35
(036-036) Spare36
(037-037) Safety_to_Move_M180
(038-038) Spare38
(039-039) Spare39
(040-040) Pick_Request_M150
(041-041) ready_to_pick_M150_vakum_on_and_OK
(042-042) place_request_M180
(043-043) place_completed_M180
(044-044) pick_request_M180
(045-045) ready_to_pick_M180_vakum_on_and_OK
(046-046) place_request_M150
(047-047) place_complated_M150
(048-048) RDY_CAM_1_AA
(049-049) RDY_CAM_2_AB
(050-050) RDY_CAM_3_BB
(051-051) RDY_CAM_4_BA
(052-052) Spare52
(053-053) Spare53
(054-054) Spare54
(055-055) NOK_Glass_placed_completed
(056-056) ready_for_spacer_plug_M170_AA
(057-057) ready_for_spacer_plug_M170_AB
(058-058) ready_for_spacer_plug_M170_BB
(059-059) ready_for_spacer_plug_M170_BA
(060-060) Spare60
(061-061) Spare61
(062-062) Spare62
(063-063) Spare63
(064-064) ready_for_spacer_check_M170_AA1
(065-065) ready_for_spacer_check_M170_AA2
(066-066) ready_for_spacer_check_M170_AB
(067-067) ready_for_spacer_check_M170_BB1
(068-068) ready_for_spacer_check_M170_BB2
(069-069) ready_for_spacer_check_M170_BA
(070-070) Spare70
(071-071) Spare71
(072-072) ready_for_spacer_unplug_M170_AA
(073-073) ready_for_spacer_unplug_M170_AB
(074-074) ready_for_spacer_unplug_M170_BB
(075-075) ready_for_spacer_unplug_M170_BA


M160 Robot Status
1
2
Signals from PLC to Robot
0 (000-007) Prog_No
(008-008) Pgno_valid
(009-009) Ext_start
(010-010) Move_Enable
(011-011) Conf_mess
(012-012) Drives_off
(013-013) Drives_on
(014-014) Spare15
(015-015) Spare16
(016-016) Spare17
(017-017) Spare18
(018-018) Spare19
(019-019) Spare20
(020-020) Spare21
(021-021) Spare22
(022-022) Spare23
(023-023) Spare24
(024-024) Spare25
(025-025) Spare26
(026-026) Spare27
(027-027) Spare28
(028-028) Spare29
(029-029) NewCrateMeasCmd
(030-030) Vac_Pump_Run
(031-031) Simulation_ON
(032-032) M163_ready
(033-033) M190_ready
(034-034) M150_High_POS
(035-035) M150_Mid_POS
(036-036) M150_Low_POS
(037-037) M180_A_Side
(038-038) M180_B_Side
(039-039) M170_ready
(040-040) authorize_to_approch_for_picking_M150
(041-041) pick_completed_M150
(042-042) autohorize_to_place_M180
(043-043) clear_to_go_back_M180
(044-044) authorize_to_approch_for_picking_M180
(045-045) pick_complated_M180
(046-046) autohorize_to_place_M150
(047-047) clear_to_go_back_M150
(048-048) vision_check_competed_AA
(049-049) vision_check_competed_AB
(050-050) vision_check_competed_BB
(051-051) vision_check_competed_BA
(052-052) NOK_Glass_after_vision_system_run
(053-053) OK_Glass_after_vision_system_run
(054-054) Spare55
(055-055) aut_to_go_back_after_NOK_MB_pla
(056-056) completed_spacer_1_AA
(057-057) completed_spacer_2_AB
(058-058) completed_spacer_3_BB
(059-059) completed_spacer_4_BA
(060-060) Completed_Spacer_Plug_AA
(061-061) Completed_Spacer_Plug_AB
(062-062) Completed_Spacer_Plug_BB
(063-063) Completed_Spacer_Plug_BA
(064-064) completed_spacer_check_1_AA1
(065-065) completed_spacer_check_1_AA2
(066-066) completed_spacer_check_2_AB
(067-067) completed_spacer_check_3_BB1
(068-068) completed_spacer_check_3_BB2
(069-069) rcompleted_spacer_check_4_BA
(070-070) Spare71
(071-071) Spare72
(072-072) completed_unplug_1_AA
(073-073) completed_unplug_2_AB
(074-074) completed_unplug_3_BB
(075-075) completed_unplug_4_BA

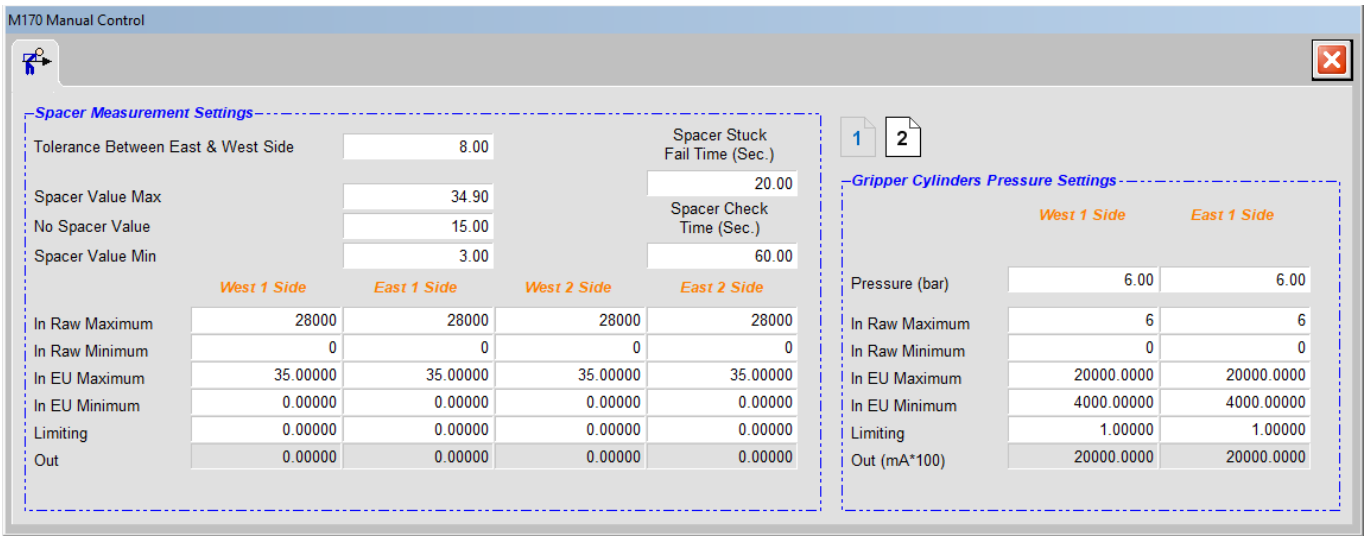
2.3.3.12 Spacer Settings Page

To open up this page you can use the Spacer Settings button on the M170 page.

This page contains both analog feedback scaling settings for all of the pneumatics on the M170 spacer application and some threshold values used in Program Mode.



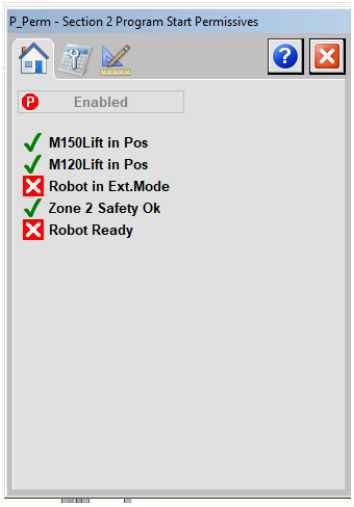
1. Allowed difference in millimeters east and west side of the spacer
2. In loading mode If the measured value is bigger than this, the program will try to unplug and plug a new spacer
3. In unloading mode, if the measured value is smaller than this, the program will try to unplug spacer again.
4. In loading mode, if the measured value is smaller than this, the program will try to unplug and plug a new spacer



2.3.3.13 Permissive and Interlock Screens

These pages can be accessed by pressing any permissive or Interlock icons. Pressing these buttons will open up the relevant screen for the given equipment. The operator then easily decide what blocks him/her to execute the given action.

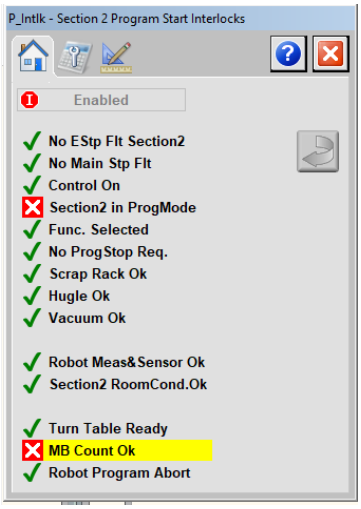
In the permissive example below, you can see, Section 2 cannot be started in Program Mode because Robot is not ready, and the Robot is not in external mode.



If anything stopped the executing action or anything blocking operator from executing the action, It can be seen in the Interlocks screen for the given action.

Green checkmarks indicate, condition for given interlock is satisfied and it is not blocking the operation.
Red crosses indicate, condition for given interlock is not satisfied and it is blocking the operation.
Yellow highlighting indicates, last blocking interlock by chronologically. So if one of the interlocks fluctuated and you missed it, yellow highlighted one even if it has green checkmark, is the one causing the issue.

In the Interlocks example below, you can see, Section 2 cannot be started in Program Mode because, Section 2 is not in Program Mode, and there is an empty crate loaded in twister while trying to Unload.

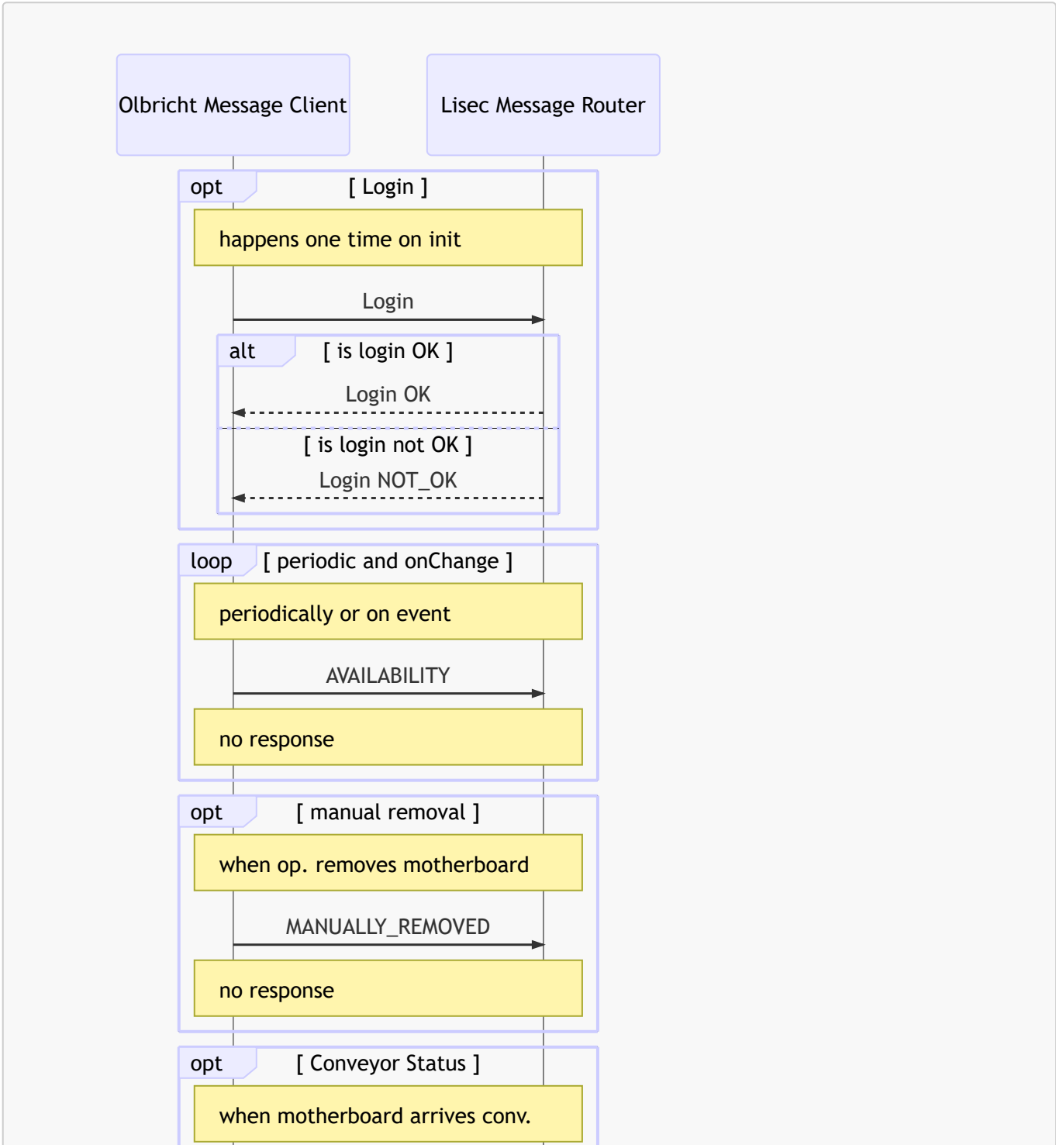


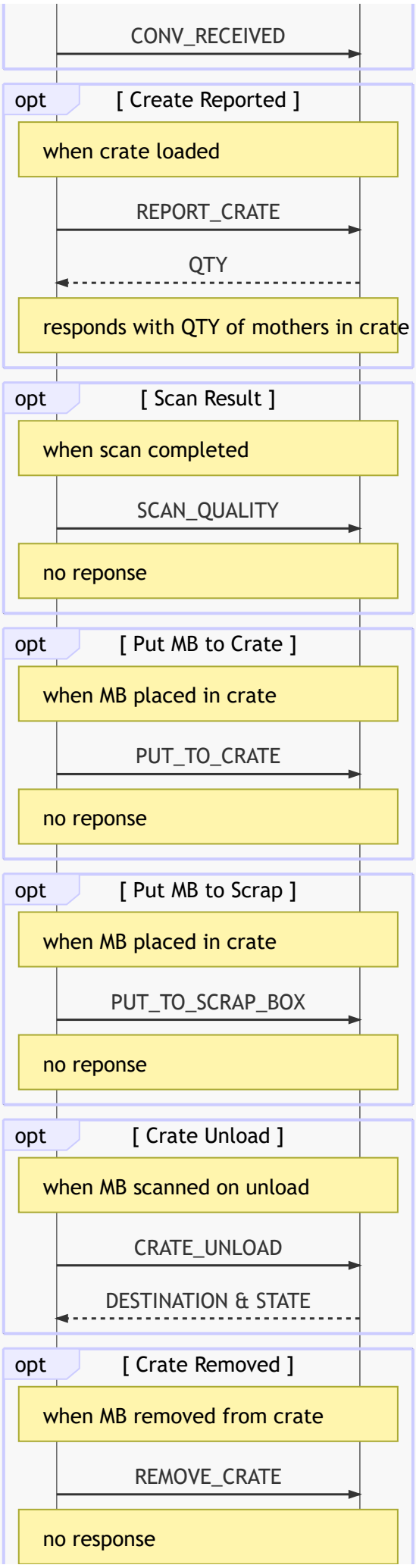
2.4 Communications

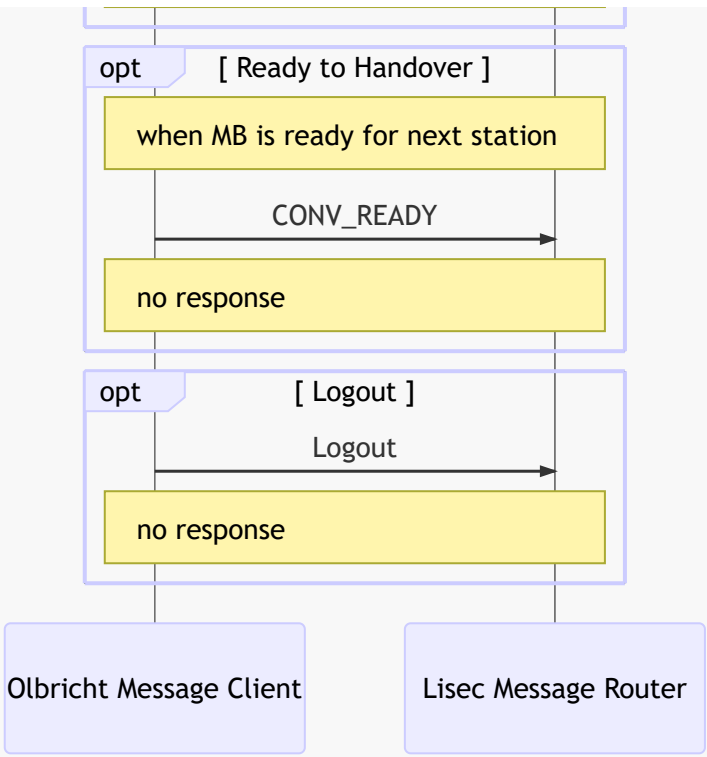
2.4.1 Lisec

Lisec communication is done over TCP/IP stack. M2S line acts as client. When booting up completes, M2S will try to Open a TCP socket connection to Lisec server. If succeful, it will try to `LOGIN`. If we can get `LOGIN_OK` response from Lisec, then M2S is communicating with the Lisec and everything is OK. In any part of the communication if we have any issues, operator will see an Alarm about the Lisec communication and will not be able to clear it until `LOGIN_OK` status is retrived from Lisec.

After connection is established, M2S line will send a following messages on corresponding actions. The full description of the messages sent can be found below.




CONV_RECEIVED
opt
[Create Reported]
when crate loaded
REPORT_CRATE
QTY
responds with QTY of mothers in crate
opt
[Scan Result]
when scan completed
SCAN_QUALITY
no reponse
opt
[Put MB to Crate]
when MB placed in crate
PUT_TO_CRATE
no reponse
opt
[Put MB to Scrap]
when MB placed in crate
PUT_TO_SCRAP_BOX
no reponse
opt
[Crate Unload]
when MB scanned on unload
CRATE_UNLOAD
DESTINATION & STATE
opt
[Crate Removed]
when MB removed from crate
REMOVE_CRATE
no response



2.4.1 Function LOGIN

2.4.1.1 Inputs

- None

2.4.1.2 Returns

- OK
- NOK

2.4.2 Function LOGOUT

2.4.2.1 Inputs

- None

2.4.2.2 Returns

- None

2.4.3 Function AVAILABILITY

M2S -> Lisec

Fires periodicly and on changes to crate and scrap box
Also current working mode sent to Lisec too e.g. Loading/Unloading

2.4.3.1 Inputs

- CRATE_AVAILABLE
  - create area status
  - 0 for **not available**
  - 1 for **available**
- SCRAP_BOX_AVAILABLE
  - scrap box status
  - 0 for **not available**
  - 1 for **available**
- MODE
  - current production/working mode
  - 1 for crate **LOADING**
  - 2 for crate **UNLOADING**
- CRATEID
  - currently active crate's id

2.4.3.2 Returns

- None

2.4.4 Function MANUALLY_REMOVED

Fires when operator manually removes the motherboard from conveyor. Can only be triggered on the HMI.

2.4.4.1 Inputs

- PARTID
  - id for removed motherboard

2.4.4.2 Returns

- None

2.4.5 Function CONV_RECEIVED

Fires when there is a new motherboard recieved at a certain conveyor.

2.4.5.1 Inputs

- PARTID
  - id for removed motherboard
- CONVEYOR
  - id/number of the conveyor

2.4.5.2 Returns

- None

2.4.6 Function REPORT_CRATE

Fires when new crate has been loaded to active crate area.

2.4.6.1 Inputs

- CRATEID
  - id of the crate
- CRATE_EMPTY
  - status of the crate
  - 0 for crate is **NOT EMPTY**
  - 1 for crate is **EMPTY**

2.4.6.2 Returns

- CRATEID
  - id of the crate
- QTY
  - number of motherboards in the crate

2.4.7 Function SCAN_QUALITY

Fires when quality scan completed.

2.4.7.1 Inputs

- PARTID
  - id of the scanned motherboard
- RESULT
  - status of the scan result
  - 0 for crate is for **BAD QUALITY**
  - 1 for crate is for **GOOD QUALITY**

2.4.7.2 Returns

- None

2.4.8 Function PUT_TO_CRATE

Fires when motherboard placed in the active crate.

2.4.8.1 Inputs

- PARTID
  - id of the motherboard which placed in the crate
- CRATE_ID
  - id of the currently active crate

2.4.8.2 Returns

- None

2.4.9 Function PUT_TO_SCRAP_BOX

Fires when motherboard placed in the scrap box.

2.4.9.1 Inputs

- PARTID
  - id of the motherboard which placed in the crate

2.4.9.2 Returns

- None

2.4.10 Function CRATE_UNLOAD

Fires after motherboard picked up from crate and scanned for quality.

2.4.10.1 Inputs

- CRATEID
  - id of the active crate
- PARTID
  - id of the picked up motherboard
- QUALITY
  - status of scan result
  - 0 for crate is for **BAD QUALITY**
  - 1 for crate is for **GOOD QUALITY**

2.4.10.2 Returns

- PARTID
  - id of the picked up motherboard
- PROCESSSTATE
  - processing state of the currently active motherboard
- DESTINATION
  - routing destination id
- SCRAP_AT_OLBRICHT
  - scrap request from Lisec
  - 0 for crate is for **GOOD QUALITY**
  - 1 for crate is for **BAD QUALITY**

2.4.11 Function REMOVE_CRATE

Fires when crate removed from active area

2.4.11.1 Inputs

- CRATEID
  - id of the removed crate
- CRATE_EMPTY
  - status of the removed crate
  - 0 for crate is **NOT EMPTY**
  - 1 for crate is **EMPTY**

2.4.11.2 Returns

- None

2.4.12 Function CONV_READY

Fires when motherboard ready to be forwarded to Manz from M2S.

2.4.12.1 Inputs

- PARTID
  - id of the motherboard to be handed over
- CONVEYOR
  - id of the conveyor which motherboard will leave

2.4.12.2 Returns

- None

2.4.13 Function CONFIRM_LOADING

Only for Loading, fires when barcode read from the motherboard on M150

2.4.13.1 Inputs

- PARTID
  - id of the motherboard to be handed over
- CRATEID
  - id of the motherboard to be handed over

2.4.13.2 Returns

- PARTID
  - id of the motherboard to be handed over
- CRATEID
  - id of the motherboard to be handed over
- LOAD
  - should we load this panel to given CRATE or NOT
  - 0 for **DO NOT LOAD**
  - 1 for **LOAD**

2.4.2 Manz

Manz communication done over Profibus connection. In the PLC there are discrete tasks and simple sequencers for handling Manz communication. Mostly equipments that needs communicate or get syncroniced with the Manz will use that communication task.

2.4.2.1 Handshake Signals

All of the Handskake bits are implemented on Both sides of the communication according the document provided by Manz. Following bits are sent during the standart handover process:

1. `Ready`: If everything is OK line and Section 2 and Section 1 is in automatic mode.
2. `Send Request`: There is a motherboard waiting on M120 to be handed over to Manz.
3. `Running`: M110 conveyor in motion.
4. `Complete`: M110 conveyor recieved the motherboard succefully.
5. `Not Busy`: There is no motherboard on the M120.
6. `Toggle Bit`: Port alive signal with 500ms period.

2.4.2.2 Substrate Data

This fields contains the data regarding the substrate that will be handed over.

1. `Substrate ID`: 10 charachter ASCII encoded string containing ID of the motherboard.
2. `Substrate Type`: Type of the motherboard. This will queried to Lisec and answer is passed on the Manz.
3. `Substrate Source`: Always send as M2Ss ID.
4. `Substrate Destination`: Destination of the motherboard. This will queried to Lisec and answer is passed on the Manz.
5. `Substrate Layout ID`: We don't pass on this information, Lisec never reports it. But it will be showed on the HMI if available.

2.4.2.3 M2S Extension

This fields are extended beyond normal EQ2EQ interface to make handover process complete.

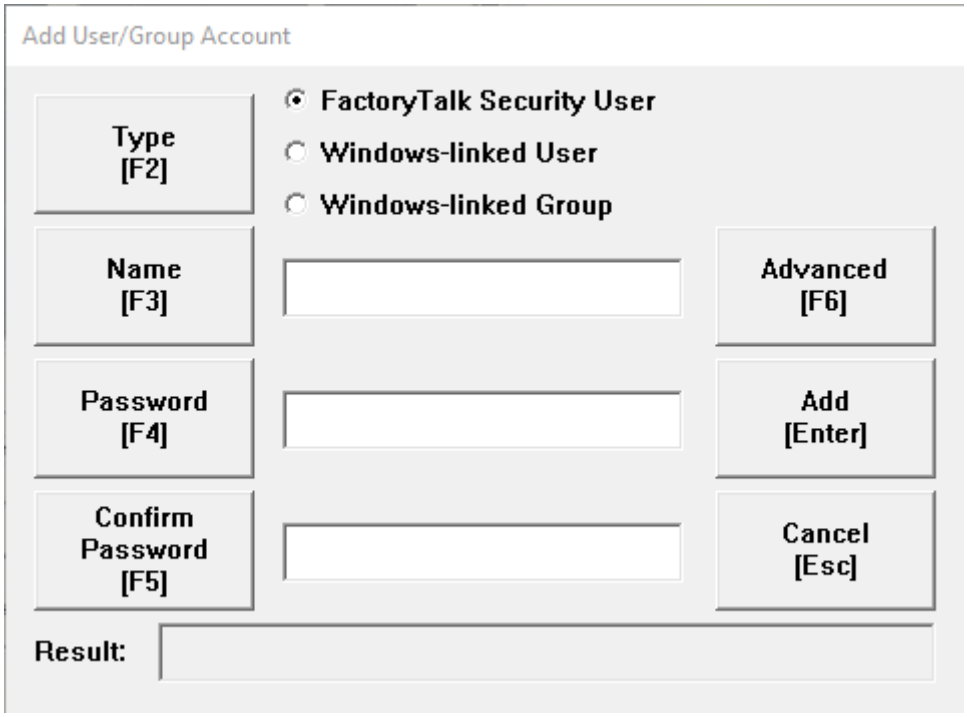
1. `Lift in Down Position`: Signal, indicating M110 in in waiting position
2. `Lift in Up Position`: Signal, indicating M110 is in M120 conveyor position
3. `Lift in Takeover Position`: Signal, indicating M110 is in Manz transfer position
4. `Ready for Takeover`: Signal, indicating the sender system is ready to handover process.

2.5 User Management

Throughout the application, `HMI_Engineer` for engineering, `HMI_Operator` for operators groups are used. For user management, adding any newly created user to one of these groups will grant them required access levels to do changes.

2.5.1 Adding User

After logging in with an user account containing a sufficient access level, accounts can be added to HMI. On the About popups User Management tab,
pressing the `Add` button will open up the following page.



Keep the FactoryTalk security user selected, and enter the desired `Name` and `Password` for the newly created user. Using the `Advanced` button, user can be:

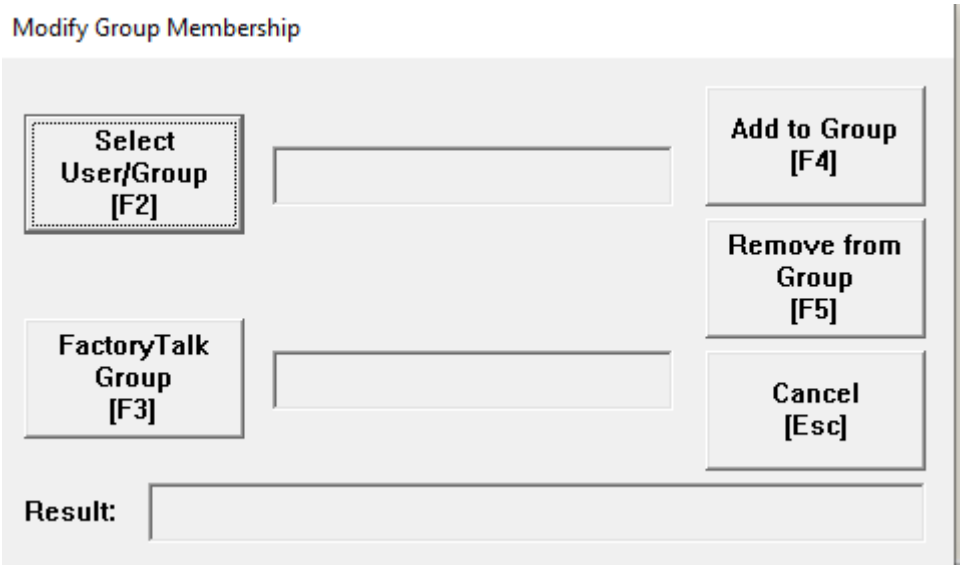
- Blocked from changing the password
- Forced to change the password on next login
- Excluded from password expirity checks
- Disabled

After pressing the `Add` button, following text will show up on the Result area:

```
Added user 'username' to user list 'Users'
```

2.5.2 Adding user to group

After logging in with an user account containing a sufficient access level, accounts can be added to HMI. On the About popups User Management tab,
pressing the `Change Group` button will open up the following page.



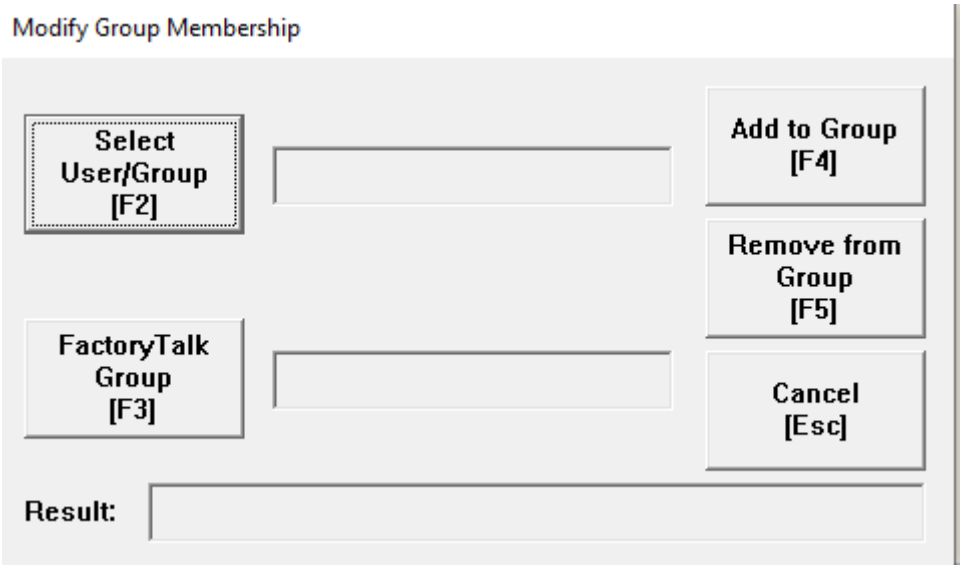
After selecting the desired user using the `Select User/Group` button, use `FactoryTalk Group` button to select the group, you want the user to be a member of.

Pressing the `Add to Group` button will add user to selected group and update the users access codes according to the group. And following text will show up on the Results area:

```
Added user '{selected user}' to user group '{selected group}'.
```

2.5.3 Removing user from group

After logging in with an user account containing a sufficient access level, accounts can be added to HMI. On the About popups User Management tab,
pressing the `Change Group` button will open up the following page.



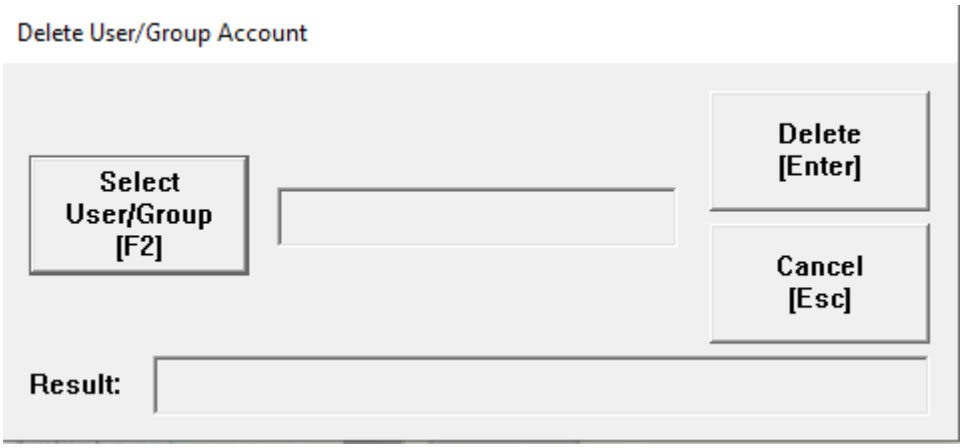
After selecting the desired user using the `Select User/Group` button, use `FactoryTalk Group` button to select the group, you want the user to be a member of.

Pressing the `Remove from Group` button will remove user from selected group and update the users access codes according to the other groups of the user. And following text will show up on the Results area:

```
Removed user '{selected user}' from user group '{selected group}'.
```

2.5.4 Deleting user

After logging in with an user account containing a sufficient access level, accounts can be added to HMI. On the About popups User Management tab,
pressing the `Delete` button will open up the following page.



Use `Select User/Group` button to select the user you wanted to delete. Pressing the Delete button will delete user and Result area will update as:

```
'{selected user}' was deleted.
```

3. Operating

3.1 Starting-Up

After powering up the M2S, all three sections of the line will be in No Mode. And Control will be off. Proper starting up sequence is as follows:

1. Power-up the main panel, wait for all equipments to boot up.
2. Select appropriate function for operation.
3. Put Control to On position on HMIs.
4. Put Section 3 to Operator or Program Mode.
5. Put Section 1 to Operator or Program Mode.
6. Put Section 2 to Operator or Program Mode.
7. Put all sections to Program Start mode.

After these, depending on the current state of the M2S, operator must follow the following sequences.

3.1.1 Cold Start

In cold start, there is no motherboard on conveyors and no crate loaded in the both sides of the M180.

1. B face of the M180 must be facing towards to Pedastal.
2. Load a crate to Pedastal.
3. Press the First Crate button on the M180-M220 Page on the HMI.
4. Putting all sections to Program Start mode will automatically load the first crate to passive area.
5. After operator opens and identifies the crate by reading barcode crate will be loaded to active area.
6. Rest of the operation is same as the normal operation.

3.1.2 Warm Start

In warm start, there could be motherboards on conveyor, and both sides of the M180 could be loaded.
If nothing is changed manually (crates or motherboards loaded/removed manually), there is no need to make any changes to normal operation.

If any motherboards loaded to conveyors manually:

1. Operator must be make sure both of the motherboard sensing sensors should be ON(both of them are sensing the motherboard).
2. The sequencer for the conveyor must adjusted to be on correct step for operation.
3. If the conveyor is after barcode scanner(barcode couldn't be scanned while normal operation continues), operator also needs to supply required information about motherboard on Lisec Interface page on HMIs.

If crate loaded/unloaded to M180 manually:

1. The sequencer for M180 must adjusted to be on correct step for operation.
2. After adjusting the operation to correct step, new barcode should be scanned to make sure Lisec communication is working as expected.

3.2 Shutting Down

3.2.1 Normal Shutdown

In normal operation, M2S will expect operator to load a new crate after passive area crate unloaded to pedestal.

To shutdown M2S for Cold Start:

1. After active area crate finishes processing(loading or unloading depending on the selected function), while the passive area is still empty
2. Operator can use the Last Crate button on the M180-220 Page of the HMIs.
3. This will force M2S to rotate even if passive area is empty and it will continue to unload the crate to pedestal.
4. After crate is on pedestal, M2S is safe to shutdown for Cold Start.

3.2.2 Emergency Shutdown

In case of power outage, M2S will go to emergency shutdown mode. When power is supplied again, everything will continue from where they left off.

If any changes happened manually while M2S is shutdown, please follow the Warm Start procedure.

3.3 Loading a Crate

In normal operation, while there is a crate in the active area, operator is expected to load another one into the passive area of the M180. If there is no crate in the active area please follow the Cold Start procedure.

This operation is executed as follows:

1. Make sure Section 3 is in Program Start mode.
2. Load a new crate to pedestal.
3. Use the `Operator Permission` button on the HMI to indicate, crate loaded to pedestal.
4. Eurofork will automatically pick up the crate and place it in the passive area of the M180.
5. Operator goes inside of the Section 3 using the man doors.
6. Operator opens up the crate, after finishes the opening up, uses the barcode scanner inside to scan barcode of the crate.
7. Operator leaves the section 3, resets the man doors. And crate will be tilted and ready to rotate in to active area.

3.4 Unloading a Crate

In normal operation, while there is a crate in the active area, operator is expected to unload the crate in the passive area of the M180. If there is no crate in the active area please follow the Normal Shutdown procedure.

This operation is executed as follows:

1. Make sure Section 3 is in Program Start mode.
2. Make sure pedestal is empty.
3. Operator goes inside of the Section 3 using the man doors. Closes the crate.
4. Operator leaves the section 3, resets the man doors.
5. Use the `Operator Permission` button on the HMI to indicate, crate is closed and ready to be transferred.
6. Eurofork will automatically pick up the crate and place it in the pedestal.

3.5 Hardwired buttons