

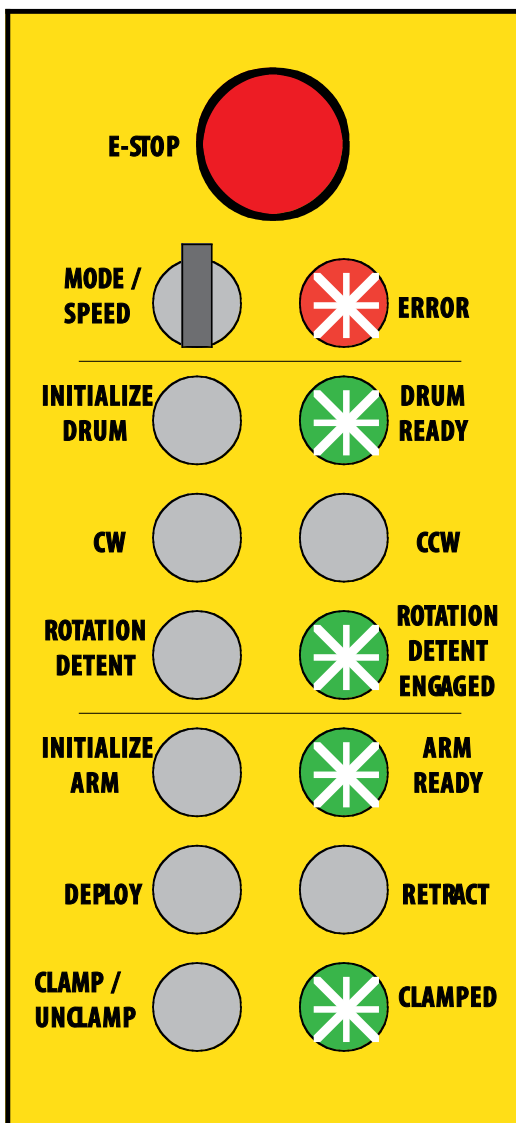
K1DM3 Design Note
Manual Control via Paddle Operation
Version 1.0, February 1, 2016
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Overview

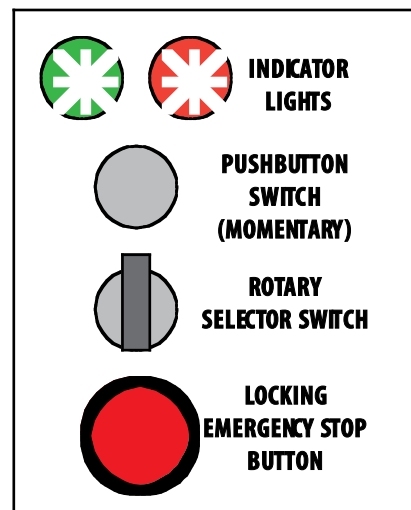
The manual control paddle will provide a simple interface to operate K1DM3 during service and maintenance. All movements will be controlled by the K1DM3 Galil motion controllers. Movements will be initiated by switches on the hand paddle. Operator feedback will be through indicator lights on the hand paddle. Optionally a display could be added to provide additional feedback.

Layout

Possible hand paddle layout:



KEY



Operation

E-STOP

E-STOP will be a latching pushbutton. The *E-STOP* button will remove all motor power from K1DM3. This will stop all motors and apply the brakes on the swing arm. *E-STOP* can be applied at any time. *E-STOP* must be deactivated for any movement on K1DM3. The *READY* indicator will turn on when *E-STOP* is deactivated and there are no errors.

Initialization

Until the motion controls have been initialized, movement will be restricted to very slow movements. This is to prevent damage to the kinematic points, the mirror mount, and the mirror.

When the drum rotation has not been initialized the *DRUM READY* indicator will be blinking. Initializing the drum is accomplished by momentarily pushing the *INITIALIZE DRUM* button. The *DRUM READY* indicator light will change from blinking to solid on once the drum has been successfully initialized.

The inner drum of K1DM3 is only powered when the drum is rotated to the deploy rotation position. Swing arm movements can only be made while the inner drum is powered. When initially powered, the *ARM READY* indicator will blink, indicated that the swing arm actuators have not been initialized. Momentarily pressing the *INITIALIZE ARM* button will attempt to initialize the swing arm. The *ARM READY* indicator will change from blinking to solid on if the swing arm is successfully initialized.

Swing Arm Retract / Deploy

Swing arm movement requires that drum be rotated to the deployment rotation position so that the inner drum is powered. The *ARM READY* indicator will be on or blinking when the inner drum is powered.

Movement commands are only allowed if the mirror is unclamped. Mirror clamped is indicated by a solid on *CLAMPED* indicator light. The mirror can be unclamped by momentarily pressing the *CLAMP / UNCLAMP* pushbutton. Attempting a prohibited move will cause the *ERROR* indicator light to blink momentarily.

Retract and deploy speed is controlled by the *MODE / SPEED* selector. Movement is initiated by pressing and holding the *RETRACT* or *DEPLOY* pushbuttons. Motion will stop when the pushbutton is released.

When moving to or past the position for mirror removal (mirror horizontal) the movement will ramp down to a stop. It will pause at this position momentarily before resuming movement. Releasing the *RETRACT* or *DEPLOY* pushbutton at this time will leave the mirror in position for re-coating removal.

The system will reduce speed when approaching the fully deployed or fully retracted position. The system will stop if either the retract or deployed position is reached. When the fully deployed position is reached, the *CLAMPED* indicator will blink to indicate that the clamps may be applied. Clamps are applied by momentarily pressing the *CLAMP / UNCLAMP* pushbutton. If clamping is successful the *CLAMPED* indicator light will change from blinking to solid on.

Drum Rotation

Rotation is only permitted if the mirror swing arm is clamped in the deployed position and the rotation detent is not engaged. The *ERROR* indicator will blink if a prohibited move is attempted. When the rotation detent is engaged the *ROTATION DETENT ENGAGED* indicator will be solid on. The detent can be disengaged by momentarily pressing the *ROTATION DETENT* pushbutton.

Rotation speed is controlled by the *MODE / SPEED* selector. Rotation movement is controlled by pressing and holding the *CW* or *CCW* pushbutton. Movement will stop when the pushbutton is released.

As each instrument detent position is approached rotation will ramp down to a stop. If the *CW* or *CCW* pushbutton is held in movement will resume after a momentary pause at the detent position. If the *CW* or *CCW* pushbutton is released the *ROTATION DETENT ENGAGED* indicator will blink to indicate that the detent can be engaged. The detent is engaged by momentarily pressing the *ROTATION DETENT* pushbutton.

Individual Control Descriptions

E-STOP

Type: locking pushbutton

Description: When engaged stops / prevents all motor movement.

ERROR indicator will be illuminated if *E-STOP* is engaged, paddle is connected, and system power is on.

MODE / SPEED SELECT

Type: 3-position rotary select switch

Description: Selects motor speed for both drum rotation and swing arm movement. Three speeds: creep, slow, and normal. Regardless of switch position only creep speed will be allowed if system has not been initialized.

ERROR

Type: Indicator lamp (red)

Description: Indicator light for error conditions.

- On = System error or *E-STOP* engaged. No movement allowed.
- Blinking = Action was prevented due to a safe operation rule.
- Off = No errors (not connected or system power off)

INITIALIZE DRUM

Type: Momentary pushbutton

Description: Pushing the button will attempt to initialize the drum rotation.

Status of drum initialization is indicated by the *DRUM READY* light.

DRUM READY

Type: Indicator light (green)

Description: Indicator light for drum motion ready.

- Off = no movement allowed.
- Blinking = can be initialized, only creep speed allowed.
- On = system initialized, ready for normal movement.

CW

Type: Momentary pushbutton

Description: Pushing the *CW* button will attempt to rotate the drum clockwise. Button must be held in for movement. Rotation will pause at each instrument position. Rotation will be prevented if rotation detent is engaged or swing arm is not deployed and clamped.

CCW

Type: Momentary pushbutton

Description: Pushing the *CCW* button will attempt to rotate the drum counter-clockwise. Button must be held in for movement. Rotation will pause at each instrument position. Rotation will be prevented if rotation detent is engaged or swing arm is not deployed and clamped.

ROTATION DETENT

Type: Momentary pushbutton

Description: Pushing the button will attempt to toggle the detent position between engaged and disengaged. Current state of detent is indicated by the *ROTATION DETENT ENGAGED* light. Detent can only be engaged when drum is rotated to an instrument position.

ROTATION DETENT ENGAGED

Type: Indicator light (green)

Description: Indicator for rotation detent status.

- Off = detent disengaged.
- Blinking = drum rotated to position where detent can be engaged.
- On = detent engaged.

INITIALIZE ARM

Type: Momentary pushbutton

Description: Pushing the button will attempt to initialize the swing arm. Status of swing arm initialization is indicated by the *ARM READY* light.

ARM READY

Type: Indicator light (green)

Description: Indicator light for swing arm motion ready.

- Off = not powered or movement not allowed.
- Blinking = can be initialized, only creep speed allowed.
- On = system initialized, ready for normal movement.

DEPLOY

Type: Momentary pushbutton

Description: Pushing the *DEPLOY* button will attempt to move the swing arm in the deploy direction. Button must be held in for movement.

Movement will pause at the horizontal mirror removal position. Movement will stop when the arm reaches the deployed position.

RETRACT

Type: Momentary pushbutton

Description: Pushing the *RETRACT* button will attempt to move the swing arm in the retract direction. Button must be held in for movement.

Movement will pause at the horizontal mirror removal position. Movement will stop when the arm reaches the retracted position. Movement will be prevented if the mirror is clamped.

CLAMP / UNCLAMP

Type: Momentary pushbutton

Description: Pushing the button will attempt to toggle between clamped and unclamped. Current state of detent is indicated by the ROTATION DETENT ENGAGED light. Detent can only be engaged when drum is rotated to an instrument position.

CLAMPED

Type: Indicator light (green)

Description: Indicator for mirror clamped status.

- Off = unclamped.
- Blinking = swing arm in deployed position, ready for clamping.
- On = clamped.