Damper control using PowerXL DH1 Variable Frequency Drives

Overview

Damper operation with the HVAC applications is a very common requirement, where the application requires opening the damper BEFORE starting the HVAC fans. This application note covers damper operation and damper interlock with the DH1 drive in three different modes:

1) During Normal electronic start, Auto and Hand
2) Normal electronic Bypass
3) Bypass mode during Emergency Faults, damper is manually operated.

References:

1) PowerXL DH1 Series VFD application manual MN040041
2) PowerXL EHB, EHC, EHD Enclosed installation manual IL040052EN

Description of Operation for each mode:

1) Normal electronic start, Auto and Hand (Local): Sequence of events during this mode:
   a. Drive in this mode is controlled in local or remote mode from the drive keypad, with SW1 in VFD position
   b. When start command is issued to the drive, Relay (RO3) on the drive closes, which powers the damper motor to turn the damper.
   c. The motion complete of the damper will close the contact DPR-K1, acknowledging that the damper motion is complete.
   d. Closure of the damper position feedback contact DPR-K1 will also pick-up relay R1, closing the contact R1-K1
   e. Closure of DPR-K1 will get the RUN ENABLE to drive, as P2.2.19 is set to DigIN: 8.
   f. With SW1 in VFD position, RUN ENABLE active the drive can be controller to the required speed reference.

Eaton DH1 supports 3 different modes for damper control. Each mode offers slightly different sequence of events in terms of the drive control philosophy.

1) **Interlock Start** : This mode is a basic damper control mode where drive controls look for damper position feedback to put drive into run enable. In an unlikely event of failure to get the damper position feedback the drive doesn't take any further action.

2) **Interlock Tout** : This mode is used when user would wants drive to fault, in an unlikely event of failure to get the damper position feedback after a preset time delay.

3) **Interlock Delay** : This mode can be used in two instances:

3.a) When the user does not have a position feedback sensor on the damper and would like to delay the drive run enable for a preselected time delay, giving enough time for damper to change the position.

3.b) When the damper position feedback is spurious and user wants drive to ignore the position feedback (till the issue is fixed) and have drive go to run enable after a preselected time delay.

Below are the recommended drive parameter settings for Damper control. *These damper control parameters are to be set in addition to standard drive commissioning parameters for the application.*

Interlock Start: Drive waits for the RUN ENABLE (Damper open position feedback) because drive Damper start has been programmed for interlock start. If damper start is left at default setting NORMAL, the damper will have to be closed before the issuing drive start CMD.

Code	Parameter	Default	Application Setting
P13.1.2	Application	0	2 = Advanced
P2.2.19	Run Enable	1	9 = DigIN: 8
P2.1.1	Damper Start	0	1 = Interlock Start
P2.2.27	Auto Control	9	0 = DigIN:NormallyOpen
P3.1.8	RO3 Function	3	35 = Damper Control

Interlock Tout: Drive waits for the RUN ENABLE (Damper open position feedback) because drive Damper start has been programmed for interlock Tout, like interlock start. Except in this case if the end switch is not made by the time **Damper Time Out** times out, the drive will fault with message "Start-up Prevent".

Code	Parameter	Default	Application Setting
P13.1.2	Application	0	2 = Advanced
P2.2.19	Run Enable	1	9 = DigIN: 8
P2.1.1	Damper Start	0	2 = Interlock Tout
P2.1.2	Damper Time Out	5	Delta normally taken by damper to close the position feedback)
P2.2.27	Auto Control	9	0 = DigIN:NormallyOpen
P3.1.8	RO3 Function	3	35 = Damper Control

Interlock Delay: Drive waits for the RUN ENABLE (Damper open position feedback) because drive Damper start has been programmed for interlock delay, like interlock start/Tout. Except in this case drive will not start until the **Damper Delay time** has lapsed.

Code	Parameter	Default	Application Setting
P13.1.2	Application	0	2 = Advanced
P2.2.19	Run Enable	1	9 = DigIN: 8
P2.1.1	Damper Start	0	3 = Interlock Delay
P2.1.2	Damper Time Out	5	User Defined Time in Seconds (Recommendation: Time + Delta normally taken by damper to close the position feedback)
P2.2.27	Auto Control	9	0 = DigIN:NormallyOpen
P3.1.8	RO3 Function	3	35 = Damper Control

2) Normal electronic Bypass: Electronic Bypass mode for the drive is when the VFD's microprocessor (MCU) is used for initiating the close command to the bypass contactor using the Bypass relay of the drive. Since the drive MCU is active, the damper control interlock is still available through drive controls due to the parameter settings discussed above. Based on the scheme in Figure: 2 there are **two** ways to initiate electronic Bypass

2.A) SW1 set to **VFD position:** The sequence of events**:**

a. The SW1 on the drive enclosure/panel is set to **VFD position**.
b. The BYPASS start is triggered from the Drives keypad. Optionally the switch on the panel/enclosure wired to DI7 (*Optional switch not shown in Figure:2*).
c. The step b above will put the drive in Bypass mode (see Figure 1).
d. Trigger the start command to the drive like the start command to the drive in VFD mode.
e. The start command to the drive will trigger RO3, initiating the damper motion.
f. After the damper position feedback is received the drive will close RO1, closing the Bypass contactor and starting the motor.

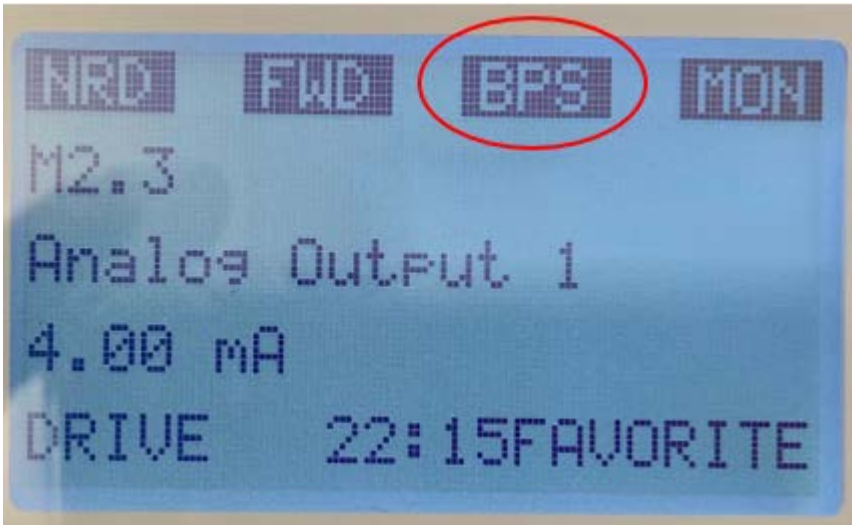

Figure: 1 Showing Drive in Bypass mode

2.B) SW1 set to **BYP position:** The sequence of events

a. The SW1 is set to **BYP position** on the drive enclosure/panel.
b. The step a above will put the drive in Bypass mode (See Figure 1).
c. Trigger start command to the drive like the start command to the drive in VFD mode.
d. The start command to the drive will trigger RO3, initiating the damper motion.
e. Once the damper position feedback is received, the bypass contactor will close. *(Please note that the damper position feedback will also close RO1 but in this mode the bypass contactor pick-up is not dependet on RO1 status)*

3) Bypass mode during Emergency Faults, damper is manually operated.

In an unlikely event of failure of the VFD control board (MCU), the user can start the motor in the bypass mode by manually moving the damper to the required position.

Sequence of events in this emergency bypass mode are as below:

a. User to manually position the damper to the required position to provide the required position feedback to run the motor.
b. After the user verifies that the required position feedback is available, user turns the SW1 to the BYP position.
c. SW1 in BYP position closes the bypass contactor starting the motor.

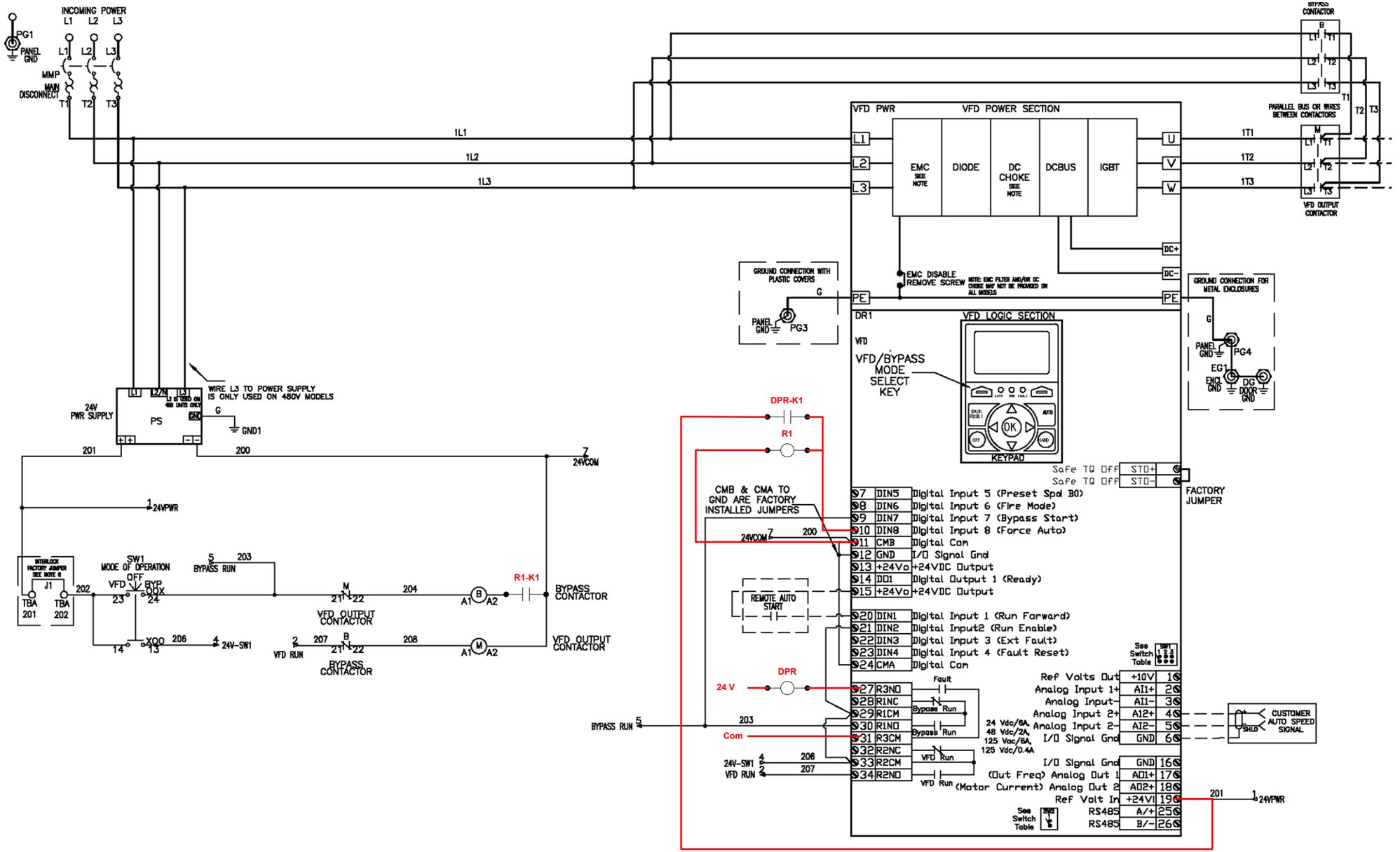

Figure 2: Standard schematic for Dh1 with damper control

Additional Help

In the US or Canada: please contact the Technical Resource Center at 1-877-ETN-CARE or 1-877-326-2273 option 2, option 6.

All other supporting documentation is located on the Eaton web site at www.eaton.com/Drives

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