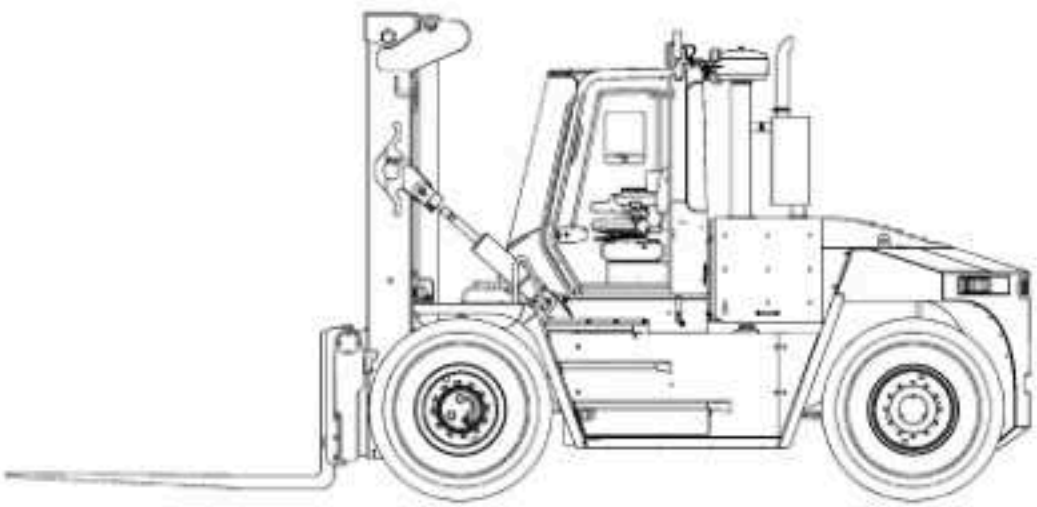
SERVICE MANUAL

H16.00-18.00XM/XMS-12
(H400-450HD/HDS) [A236]



FORM 1650990 Rev. 08/14

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This section is for the following models:

H14.00-20.00XM [A214];
H16.00-18.00XM-12EC (H400-450H-EC) [A214];
H16.00-18.00XM/XMS-12 (H400-450HD/HDS) [A236];
H16.00-22.00XM-12EC (H400-500HD/HDS-EC) [B214];
H16XM-12, H18XM-12, H20XM-12, H22XM-12 (H400HD, H450HD, H500HD, H550HD) [B236];
H16XM-12EC, H18XM-12EC, H22XM-12EC (H400HD-EC, H450HD-EC, H500HD-EC) [C214]

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a letter and four numbers for each fault code. For engine fault codes, the letter is 'E'. For transmission fault codes, the letter is 't'.

After the fault code, three numbers are shown which represent the following:
- Fault code
- Hourmeter reading at last occurrence
- Hourmeter reading at first occurrence
- Number of occurrences of current fault

Each number is shown for three seconds, after which the following number is shown. The faults will be shown in the opposite sequence of occurrence: the most recent fault first and the initial fault last. When all recorded fault codes have been shown, the display will continue to repeat the recorded fault codes until the user exits the fault log mode.

Exit

To exit the fault log mode, turn the key switch **OFF** and then **ON**, leaving the key switch **ON** for more than two seconds. The cluster will also exit to normal mode when the parking brake is released or when the engine is started.

Clear

To clear the fault codes logged in the display, proceed as follows:

1. Access the fault log mode. See Access.
2. Clear the fault log by cycling the ignition key **OFF** and **ON** three more times. This is a repetition of the procedure to access the fault log mode. See Access.

If the data-erasing process is successful, the display will show 'clear'. If the data-erasing process is not successful, the display will show the fault codes in the memory, shown in the order by the time of the occurrence. To return to the normal mode, follow the procedure as described in Exit. To retry erasing stored fault codes, follow Step 2 of the procedure to clear fault codes.

Fault Identification

Fault codes are listed in **APC200 Fault Code Guide** 1300 SRM 1435, which provides an explanation of the fault, the resulting action of the APC200 controller, and checks for troubleshooting. Each fault code represents a specific defect or malfunction.

In most cases, the suggested solution is to check electrical functionality between the APC200, the wiring and sensors, solenoids, or switches.

Before disassembling components for test purposes, connect the Dana Dashboard software. The screen 'Dashboard-Monitor' allows verification of the functionality of speed sensors, the pressure switch, and the shift lever. If several possible defects are indicated, Dana Dashboard software may narrow down the number of possible defects, preventing unnecessary removal of components that function correctly.

To repair problems with switches, solenoids, and sensors, look up their actual location, and test the component. The location of the solenoids are shown in the section Transmission Control Valve. The location of sensors and switches are shown in the section Pressure, Speed, and Temperature Sensors. Test values of solenoids and sensors are shown in the section Electrical Specifications.

Note that the Dana Dashboard software and the Fault Code List have wire references and input references that relate to the APC200.

The references to **Hyster** wire numbers and **Hyster** descriptions are shown in Table 8, Table 9, Table 10, Table 11, and Table 12.

Refer to Table 13 for the conversion from APC200 wire numbers to **Hyster** wire numbers.

To determine the exact location of a harness problem, refer to **Electrical System** 2200 SRM 1397.

TRANSMISSION CONTROL VALVE

The transmission control valve is a hydraulically operated valve and is located at the front of the transmission. The transmission control valve consists of a modulator valve, a regulator valve, and a distribution plate. See Figure 5.

The functioning of the transmission control valve depends on the available pump supply pressure and the activation of the electrical solenoids. The activation of the electrical solenoids is controlled by the APC200 controller. For the hydraulic control valve schematic, see Figure 4.

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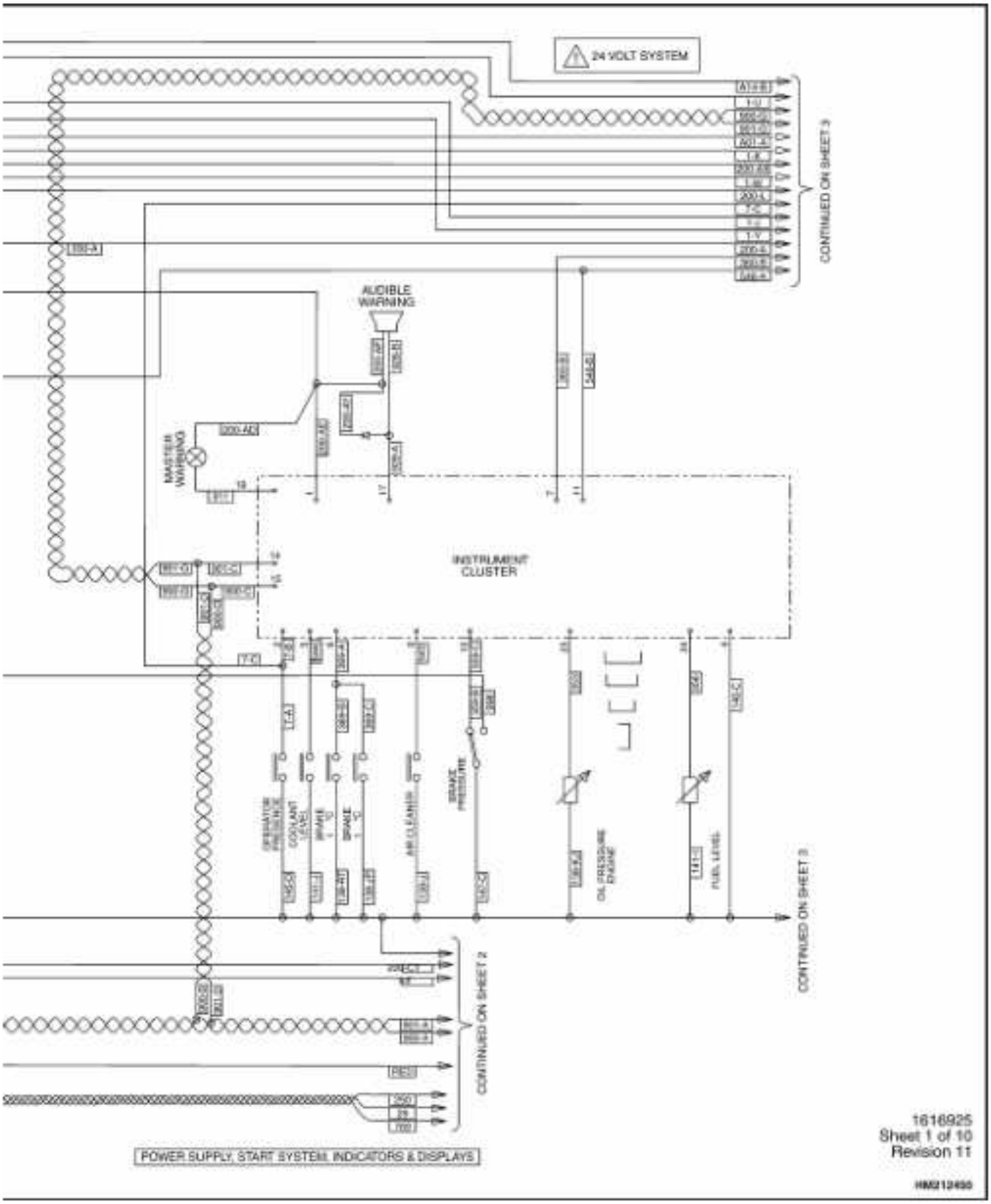


Figure 1. Electrical Schematic (Sheet 1 of 10)

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Counterweight Weights

Unit	Main Counterweight
H16.00XM-12	8,300 to 8,400 kg (18,298 to 18,519 lb)
H16.00XMS-12	9,000 to 9,100 kg (19,842 to 20,062 lb)
H18.00XM-12	9,630 to 9,730 kg (21,231 to 21,451 lb)
H18.00XMS-12	9,630 to 9,730 kg (21,231 to 21,451 lb)
H400HD	8,300 to 8,400 kg (18,298 to 18,519 lb)
H400HDS	9,000 to 9,100 kg (19,842 to 20,062 lb)
H450HD	9,630 to 9,730 kg (21,231 to 21,451 lb)
H450HDS	9,630 to 9,730 kg (21,231 to 21,451 lb)

Vehicle Weights

Unit	Weight
H16.00XM-12	26,617 kg (58,678 lb)
H16.00XMS-12	27,347 kg (60,290 lb)
H18.00XM-12	29,046 kg (64,036 lb)
H18.00XMS-12	30,030 kg (66,205 lb)
H400HD	26,617 kg (58,678 lb)
H400HDS	27,347 kg (60,290 lb)
H450HD	29,046 kg (64,036 lb)
H450HDS	30,030 kg (66,205 lb)

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Pressure Switch

The pressure switch signals if system pressure is applied by the clutch supply valve to the intensifier valves.

Test

When system pressure is above 16.5 bar (239 psi), the internal resistance of the pressure switch is 1 kOhm. When no pressure is applied, the internal resistance is 2 kOhms. The APC200 controller measures the actual resistance and determines that the following conditions exist:

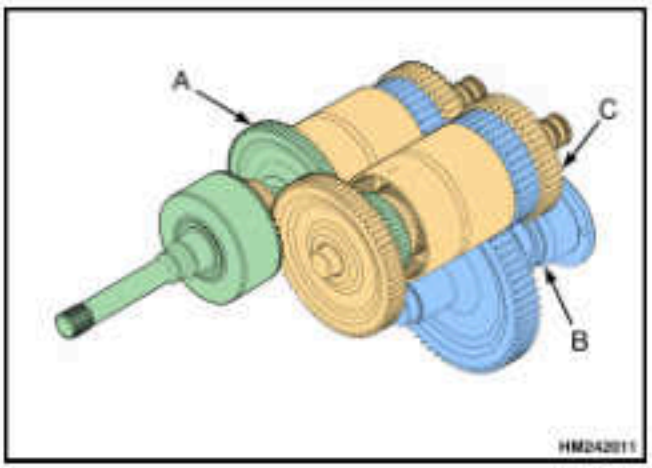
- 0 to 500 Ohms - Short circuit.
- 500 to 1,500 Ohms - System pressure applied.
- 1,500 to 4,000 Ohms - No system pressure.
- 4,000 Ohms or higher - Open circuit.

Verify the pressure circuit resistance by opening the Monitor screen in the Dana Dashboard software. View either the Pressure Switch Resistance Gauge or the Analog Input Signal for the pressure switch (Analog input 0). The location of the pressure switch is shown in Figure 6.

Speed Sensor

The speed sensors determine the rotation speed of the different gear groups. The APC200 controller calculates the speed ratios between the different groups and compares the calculated values with the programmed values. If deviation exceeds an allowable value, the APC200 controller generates a fault code and eventually enters a protection mode. See Figure 14. The following are a few examples of speed inputs and ratios that are monitored by the APC200 controller:

- Converter Speed Ratio
  - The ratio between engine speed and turbine speed is called the converter speed ratio. The converter speed ratio is a measure of the power being transferred through the converter. This ratio is a major factor for the APC200 controller to determine if a higher or lower gear is to be selected during the automatic selection mode. During calibration, a sudden change in converter speed ratio is used to determine the clutch piston position at the moment the clutch starts clamping.
- Transmission Ratio
  - Each selected transmission gear has a specific transmission ratio. When one of the direction clutches is closed and the output speed has reached a certain value for checking, the actual ratio is compared with the specified ratio. If deviation exceeds 5%, one of the clutches is assumed to be slipping. A fault is flagged and the APC200 controller enters the Shut Down Mode.
- Gear Ratio
  - If the turbine, drum, or output speed sensor fails, the APC200 controller calculates the 'actual ratio' based on the value of the remaining sensors. This allows continued operation of the transmission. Speed sensor failure is indicated by a fault code. If the engine speed sensor fails, or if more than one speed sensor fails, the APC200 controller will enter the Limp Home Mode and flag a fault.
- Maximum Torque During Inching
  - The APC200 programming interprets the inching pedal position as the required pressure for the inching clutch. The heat generated in the inching clutch is proportional to the power transferred by the torque converter (converter speed ratio). When the power is transferred at an excessively high level for an extended period of time, the APC200 controller will release pressure in the clutch and flag a fault.



A. TURBINE SPEED
B. OUTPUT SPEED
C. DRUM SPEED

Figure 14. Schematic Speed Sensor Locations

Test

Dana Dashboard software shows functionality of each of the speed sensors under 'Speed Monitor'. Electrical functionality can be tested by using the schematic shown in Figure 15. Observe the correct sensor polarity. Pin 1 must be connected to 12 Volt+. Pin 2 must be connected to 12 Volt . For the engine speed sensor, pin A must be connected to 12 Volt+.

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Description

The main part of the electrical system is the one-piece, main electrical wire harness. The batteries provide the main electrical wire harness with electricity and then the main electrical wire harness transmits the electricity to several components (senders, warning lights, etc.). See Figure 1 and the section **Instrument Panel Indicators and Senders** 2200 SRM 1278 for further information regarding senders and indicator functions.

An oil cooler is connected to the main electrical wire harness at location C240 and a rear harness is connected to the main electrical wire harness at location C190. See Figure 1. The oil cooler harness provides the hydraulic oil cooler with electricity. See Figure 2. The rear harness provides the rear lights and alarm with electricity. See Figure 3.

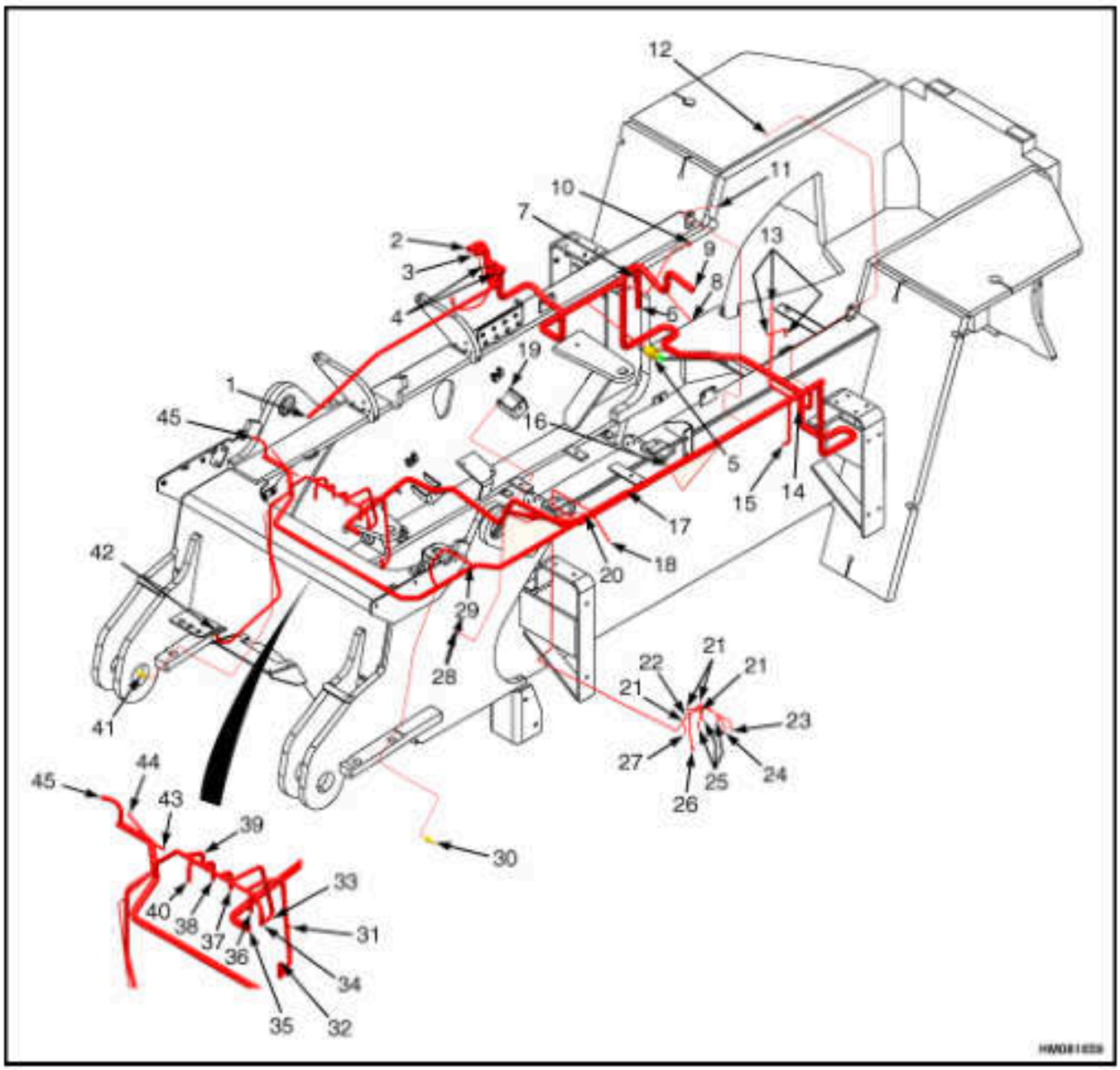


Figure 1. Electrical Wire Harness

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