1. Thrust Reverser System Controls
   A. General

FED 801-802, 805-806, 808-815
   The thrust reverser is controlled by a separate lever installed on the engine throttle control lever (Ref. Fig. 001). The following particular safety features are provided:

FED 803-804, 807
   The thrust reverser is controlled by a separate lever installed on the engine throttle control lever (Ref. Fig. 002). The following particular safety features are provided:

FED 801-815
   - To avoid inadvertent thrust reverser deployment when in forward thrust, the mechanical design of the throttle control lever prevents actuation of the thrust reverser lever to the deploy position when the throttle control lever is not in idle position.
   - To facilitate reverse operation, a mechanical friction point is introduced in the reverse control lever mechanism. This indicates to the crew that the idle threshold is reached. This threshold must be overridden to increase reverse thrust by moving the thrust reverser lever.

2. Component Location
   (Ref. Fig. 003, 004, 005)

<table>
<thead>
<tr>
<th>FIN</th>
<th>FUNCTIONAL DESIGNATION</th>
<th>PANEL</th>
<th>ZONE</th>
<th>ACCESS DOOR</th>
<th>ATA REF.</th>
</tr>
</thead>
<tbody>
<tr>
<td>S304</td>
<td>DRIVE UNIT - PNEUMATIC</td>
<td></td>
<td>435</td>
<td>435AL</td>
<td>(Ref. 78-31-01 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>445</td>
<td>445AL</td>
<td></td>
</tr>
<tr>
<td>H9</td>
<td>VALVE - PRESSURE REGULATING AND SHUT OFF</td>
<td></td>
<td>436</td>
<td>436AR</td>
<td>(Ref. 78-31-05 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>446</td>
<td>446AR</td>
<td></td>
</tr>
<tr>
<td>H15</td>
<td>VALVE SELECTOR, SOLENOID OPERATED ACTUATOR - MASTER AND SLAVE</td>
<td></td>
<td>435</td>
<td>435AL</td>
<td>(Ref. 78-31-10 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>445</td>
<td>445AL</td>
<td></td>
</tr>
<tr>
<td>S301</td>
<td>STOW/DEPLOY RVDT SWITCHES (RH)</td>
<td></td>
<td>453</td>
<td>451AL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>463</td>
<td>461AL</td>
<td></td>
</tr>
</tbody>
</table>
## FIN - FUNCTIONAL DESIGNATION

<table>
<thead>
<tr>
<th>FIN</th>
<th>FUNCTIONAL DESIGNATION</th>
<th>PANEL</th>
<th>ZONE</th>
<th>ACCESS DOOR</th>
<th>ATA REF.</th>
</tr>
</thead>
<tbody>
<tr>
<td>S307</td>
<td>STOW/DEPLOY RVDT SWITCHES (LH)</td>
<td>463</td>
<td>461AL</td>
<td></td>
<td>(Ref. 78-31-15)</td>
</tr>
<tr>
<td>454</td>
<td></td>
<td>452AR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>464</td>
<td></td>
<td>462AR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>463</td>
<td>CRANK ARM - FEEDBACK</td>
<td>453</td>
<td>451AL</td>
<td></td>
<td>(Ref. 78-31-40)</td>
</tr>
<tr>
<td>463</td>
<td></td>
<td>461AL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>436</td>
<td>PNEUMATIC VALVE - GROUND</td>
<td>436</td>
<td>436AR</td>
<td></td>
<td>(Ref. 78-31-40)</td>
</tr>
<tr>
<td>446</td>
<td>OPERATING AIR TRANSFER</td>
<td>446</td>
<td>446AR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>435</td>
<td>DUCTS - SUPPLY, PDU</td>
<td>435</td>
<td>435AL</td>
<td></td>
<td>(Ref. AMM 78-31-21)</td>
</tr>
<tr>
<td>445</td>
<td></td>
<td>445AL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>435</td>
<td>GEARBOX - SPLITTER</td>
<td>435</td>
<td>435AL</td>
<td></td>
<td>(Ref. AMM 78-31-33)</td>
</tr>
<tr>
<td>445</td>
<td></td>
<td>445AL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>435</td>
<td>PNEUMATIC HOSE - THRUST REVERSER</td>
<td>435</td>
<td>435AL</td>
<td></td>
<td>(Ref. AMM 78-31-33)</td>
</tr>
<tr>
<td>445</td>
<td></td>
<td>445AL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>453</td>
<td>FLEXIBLE SHAFT ASSEMBLIES</td>
<td>453</td>
<td>451AL</td>
<td></td>
<td>(Ref. AMM 78-31-33)</td>
</tr>
<tr>
<td>463</td>
<td>THRUST REVERSER</td>
<td>463</td>
<td>461AL</td>
<td></td>
<td>(Ref. AMM 78-31-33)</td>
</tr>
<tr>
<td>435</td>
<td></td>
<td>435AL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>445</td>
<td></td>
<td>445AL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>453</td>
<td>SENSOR TUBES - THRUST REVERSER</td>
<td>453</td>
<td>451AL</td>
<td></td>
<td>(Ref. AMM 78-31-33)</td>
</tr>
<tr>
<td>463</td>
<td></td>
<td>461AL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**FED 801-815**

**POST SB 78-2019 for A/C 801-815**

- To avoid inadvertent thrust reverser deployment when in forward thrust,
- the mechanical design of the throttle control lever prevents actuation of
- the thrust reverser lever to the deploy position when the throttle

---

**P.Bik EFFECTIVITY:** FED 801-815

---

**78-31-00-00**

Printed - Date: 12/06/12 Time:
Copyright © 12 FedEx Express Corporation, Memphis TN, 38194, All rights reserved.

Page 2 of 57
DEC 01/2005
- control lever is not in idle position.
- To facilitate reverse operation, a mechanical friction point is introduced
- in the reverse control lever mechanism. This indicates to the crew that
- the idle threshold is reached. This threshold must be overridden to increase
- reverse thrust by moving the thrust reverser lever.

## 2. Component Location
(Ref. Fig. 003,004,006 )

<table>
<thead>
<tr>
<th>FIN</th>
<th>FUNCTIONAL DESIGNATION</th>
<th>PANEL</th>
<th>ZONE</th>
<th>ACCESS DOOR</th>
<th>ATA REF.</th>
</tr>
</thead>
<tbody>
<tr>
<td>S304</td>
<td>DRIVE UNIT - PNEUMATIC</td>
<td>435</td>
<td>435AL</td>
<td>435AL</td>
<td>(Ref. 78-31-01 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>445</td>
<td>445AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H9</td>
<td>VALVE - PRESSURE REGULATING AND SHUT OFF</td>
<td>436</td>
<td>436AR</td>
<td>436AR</td>
<td>(Ref. 78-31-05 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>446</td>
<td>446AR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H15</td>
<td>VALVE SELECTOR, SOLENOID OPERATED ACTUATOR - MASTER AND SLAVE</td>
<td>435</td>
<td>435AL</td>
<td>435AL</td>
<td>(Ref. 78-31-10 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>445</td>
<td>445AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ACTUATOR - MASTER AND SLAVE</td>
<td>453</td>
<td>451AL</td>
<td>451AL</td>
<td>(Ref. 78-31-15 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>463</td>
<td>461AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S301</td>
<td>STOW/DEPLOY RVDT SWITCHES (RH)</td>
<td>453</td>
<td>451AL</td>
<td>451AL</td>
<td>(Ref. 78-31-40 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>463</td>
<td>461AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S307</td>
<td>STOW/DEPLOY RVDT SWITCHES (LH)</td>
<td>454</td>
<td>452AR</td>
<td>452AR</td>
<td>(Ref. 78-31-40 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>464</td>
<td>462AR</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CRANK ARM - FEEDBACK</td>
<td>453</td>
<td>451AL</td>
<td>451AL</td>
<td>(Ref. AMM 78-31-21)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>463</td>
<td>461AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PNEUMATIC VALVE - GROUND</td>
<td>436</td>
<td>436AR</td>
<td>436AR</td>
<td>(Ref. 78-31-33 )</td>
</tr>
<tr>
<td></td>
<td>OPERATING AIR TRANSFER</td>
<td>446</td>
<td>446AR</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DUCTS - SUPPLY, PDU</td>
<td>435</td>
<td>435AL</td>
<td>435AL</td>
<td>(Ref. 78-31-34 )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>445</td>
<td>445AL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Functional Designation

<table>
<thead>
<tr>
<th>FIN</th>
<th>Panel</th>
<th>Zone</th>
<th>Access Door</th>
<th>ATA Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEARBOX - SPLITTER</td>
<td>435</td>
<td>435AL</td>
<td>(Ref. 78-31-35)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>445</td>
<td>445AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PNEUMATIC HOSE - THRUST REVERSER</td>
<td>435</td>
<td>435AL</td>
<td>(Ref. AMM 78-31-57)</td>
<td></td>
</tr>
<tr>
<td>FLEXIBLE SHAFT ASSEMBLIES</td>
<td>453</td>
<td>451AL</td>
<td>(Ref. 78-31-12)</td>
<td></td>
</tr>
<tr>
<td>THRUST REVERSER</td>
<td>463</td>
<td>461AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SENSOR TUBES - THRUST REVERSER</td>
<td>453</td>
<td>451AL</td>
<td>(Ref. 78-31-36)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>463</td>
<td>461AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H16 LOCK - SYNCHRONOUS SHAFT (RH)</td>
<td>453</td>
<td>451AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H17 LOCK - SYNCHRONOUS SHAFT (LH)</td>
<td>463</td>
<td>461AL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### FED 801-815

3. Thrust Reverser Actuation System Operation

A. General
   (Ref. Fig. 007,009,011)
   (Ref. Fig. 012,013)
   These figures show the detailed scheme of the pneumatic actuation. The system is electrically controlled as described in paragraph E.

B. Operation
   (Ref. Fig. 007)

   - To deploy
     - To deploy the system, the throttle control lever is moved to idle and reverser control lever is rotated up. An electrical deploy command is then applied to the latching deploy solenoid valve simultaneously with an electrical signal to the arming solenoid valve which supplies air to the control switcher, shifting it to the open position.
     - Inlet air flows through the manual deactivation valve, the open control switcher, and the reference regulator of the lock actuator of RH master actuator. The safety relief valve provides downstream component protection in the event of a failure of the reference regulator. If the ballscrew is positioned within 1/8" of the fully stowed position, the lock cam permits the lock actuator to stroke. This ports air to the lock actuator of LH master actuator which executes a similar sequence, supplying air to the arming port of the
pressure regulator and shutoff valve. The orifice check valve opens and air flows into the opening chamber of the valve actuator. As the butterfly opens, the sensing port directs regulated pressure to the feedback chamber of the valve actuator.

- The resulting equilibrium regulates the supply air pressure to the pneumatic drive unit.

- Regulated air flows through the latching deploy solenoid valve and shifts the electrical selector valve to the deploy position. This ports air to the deploy port of the pneumatic drive unit and shifts the directional valve actuator to the deploy mode. This strokes the feedback cam to the right of both the stow and deploy dump valves. With both dump valves seated, the brake dump valve seats and regulated air flows into the brake actuator and the brake releases. The directional valve, which had been rotated to the wide-open deploy position by the directional valve actuator, directs air to the air motor to accelerate it in the deploy direction of rotation.

- The system of flexshafts, gearboxes, and ballscrews translates the thrust reverser sleeve toward the deploy position. The feedback screw in the pneumatic drive unit rotates in relation to the air motor and translates the feedback nut until it contacts the feedback mechanism and strokes it to the null position. This progressively closes the directional valve, which causes the air motor to decelerate, and also strokes the feedback cam into contact with the deploy dump valve poppet which is stroked and vents the brake dump valve, which opens and rapidly vents the brake actuator. This applies the brake, which completes deceleration of the system to an accurate stop in the deploy position. The feedback modules, located on the master actuators, provide electrical position inputs to the airframe which indicate that both sleeves of the reverser are deployed and ready for application of reverse power. The feedback module also includes a deploy limit switch to provide flight compartment indication that the reverser is in the deploy position.

- To stow (Ref. Fig. 009)

- To stow the system, the reverser control lever is rotated down into the forward thrust position. An electrical stow command is then applied to the latching deploy solenoid valve which directs regulated air to shift the electrical selector valve to the stow position. Regulated air is directed to the stow port of the pneumatic drive unit and shifts the directional valve actuator to the stow mode. This strokes the feedback cam to the left of the stow and deploy
dump valves and allows them to seat. The brake dump valve seats and air pressurizes the brake actuator which strokes to release the brake.

- The directional valve, which had been rotated to the wide-open stow position by the directional valve actuator, admits air to the air motor to accelerate it in the stow direction of rotation to translate the system toward stow. When the feedback nut contacts the feedback mechanism, it strokes it toward the null position, which progressively closes the directional valve. The air motor decelerates and slows the system until stow contact is made.

- Electrical power is removed from the arming solenoid valve, which closes and vents the control switcher. RH, and then the LH, lock actuator return to the at-rest position, venting the arming port of the pressure regulator and shutoff valve. The orifice check valve seats, providing a slow closure of the valve and a resultant slow decay of the regulated pressure. A slot included in the contour of the directional valve causes the air motor to develop a residual stall torque in the stow direction when the directional valve is in the stow null position.

- This allows the pneumatic drive unit to apply a residual stowing torque to the flexshafts to assure stow stop contact. As the inlet pressure slowly decays, the brake dump valve rapidly vents the brake actuator, which applies the brake before the motor inlet pressure is removed, locking this residual torque into the flexshafts.

- The feedback module stow switches provide cockpit indication that the reverser is fully stowed and remove the electrical power from the arming solenoid. The feedback module also provides a dual proportional electrical feedback signal to the electronic engine controller from an integral RVDT unit. Additional features of the actuation system include the following.

- Electrical switches indicate unlock of the lock actuators in the master actuators, and also brake release in the pneumatic drive unit. The stow dump valve is positioned so that it is not contacted during a normal stow cycle with the pneumatic drive unit rigged into the system. However, it is provided for use during bench calibration of the pneumatic drive when an accurate stop is required in the stow position to provide a repeatable basis for the rev count.

- The manual deactivation valve serves to de-activate the system by both manually closing the butterfly in the pressure regulator and shutoff valve and removing the source of control air upstream of the control switcher.
3. **FED 801-815**  
**POST SB 78-2019 for A/C 801-815**  
Thrust Reverser Actuation System Operation

A. General  
(Ref. Fig. 008,010,011)  
(Ref. Fig. 012,013)  
These figures show the detailed scheme of the pneumatic actuation. The system is electrically controlled as described in paragraph E.

B. Operation  
(Ref. Fig. 001,008)  
- To deploy  
  - To deploy the system, the throttle control lever is moved to idle and reverser control lever is rotated up. An electrical deploy command is then applied to the latching deploy solenoid valve simultaneously with an electrical signal to relay 46KM (47KM), which supplies both synchronous shaft lock solenoids and relay 48KM (49KM) coil. After 250 ms, relay 48KM (49KM) closes and an electrical signal is sent to the arming solenoid valve which supplies air to the control switcher, shifting it to the open position.
  
  - Inlet air flows through the manual deactivation valve, the open control switcher, and the reference regulator of the lock actuator of RH master actuator. The safety relief valve provides downstream component protection in the event of a failure of the reference regulator. If the ballscrew is positioned within 1/8'' of the fully stowed position, the lock cam permits the lock actuator to stroke. This ports air to the lock actuator of LH master actuator which executes a similar sequence, supplying air to the arming port of the pressure regulator and shutoff valve. The orifice check valve opens and air flows into the opening chamber of the valve actuator. As the butterfly opens, the sensing port directs regulated pressure to the feedback chamber of the valve actuator.
  
  - The resulting equilibrium regulates the supply air pressure to the pneumatic drive unit.
  
  - Regulated air flows through the latching deploy solenoid valve and shifts the electrical selector valve to the deploy position. This ports air to the deploy port of the pneumatic drive unit and shifts the directional valve actuator to the deploy mode. This strokes the feedback cam to the right of both the stow and deploy dump valves. With both dump valves seated, the brake dump valve seats and regulated air flows
into the brake actuator and the brake releases. The directional valve, which had been rotated to the wide-open deploy position by the directional valve actuator, directs air to the air motor to accelerate it in the deploy direction of rotation.

- The system of flexshafts released by the synchronous shaft locks, gearboxes, and ballscrews translates the thrust reverser sleeve toward the deploy position. The feedback screw in the pneumatic drive unit rotates in relation to the air motor and translates the feedback nut until it contacts the feedback mechanism and strokes it to the null position.

- This progressively closes the directional valve, which causes the air motor to decelerate, and also strokes the feedback cam into contact with the deploy dump valve poppet which is stroked and vents the brake dump valve, which opens and rapidly vents the brake actuator.

- This applies the brake, which completes deceleration of the system to an accurate stop in the deploy position. The feedback modules, located on the master actuators, provide electrical position inputs to the airframe which indicate that both sleeves of the reverser are deployed and ready for application of reverse power. The feedback module also includes a deploy limit switch to provide flight compartment indication that the reverser is in the deploy position.

- To stow (Ref. Fig. 010)

- To stow the system, the reverser control lever is rotated down into the forward thrust position. An electrical stow command is then applied to the latching deploy solenoid valve which directs regulated air to shift the electrical selector valve to the stow position. Regulated air is directed to the stow port of the pneumatic drive unit and shifts the directional valve actuator to the stow mode. This strokes the feedback cam to the left of the stow and deploy dump valves and allows them to seat. The brake dump valve seats and air pressurizes the brake actuator which strokes to release the brake.

- The directional valve, which had been rotated to the wide-open stow position by the directional valve actuator, admits air to the air motor to accelerate it in the stow direction of rotation to translate the system toward stow. When the feedback nut contacts the feedback mechanism, it strokes it toward the null position, which progressively closes the directional valve. The air motor decelerates and slows the system until stow contact is made.

- Electrical power is removed from the arming solenoid valve, which closes and vents the control switcher. RH, and then
the LH, lock actuator return to the at-rest position, venting the arming port of the pressure regulator and shutoff valve. The orifice check valve seats, providing a slow closure of the valve and a resultant slow decay of the regulated pressure. A slot included in the contour of the directional valve causes the air motor to develop a residual stall torque in the stow direction when the directional valve is in the stow null position.

- This allows the pneumatic drive unit to apply a residual stowing torque to the flexshafts to assure stow stop contact. As the inlet pressure slowly decays, the brake dump valve rapidly vents the brake actuator, which applies the brake before the motor inlet pressure is removed, locking this residual torque into the flexshafts.

- The feedback module stow switches provide cockpit indication that the reverser is fully stowed and remove the electrical power from the arming solenoid. The feedback module also provides a dual proportional electrical feedback signal to the electronic engine controller from an integral RVDT unit. Ten seconds after a stow command, the synchronous shaft lock solenoids are de-energized (opening of relay 46KM (47KM)), the armature is released and the pins re-engage, which prevents triangular rotor plate from rotating. Additional features of the actuation system include the following.

- Electrical switches indicate unlock of the lock actuators in the master actuators, and also brake release in the pneumatic drive unit. The stow dump valve is positioned so that it is not contacted during a normal stow cycle with the pneumatic drive unit rigged into the system. However, it is provided for use during bench calibration of the pneumatic drive when an accurate stop is required in the stow position to provide a repeatable basis for the rev count.

- The manual deactivation valve serves to de-activate the system by both manually closing the butterfly in the pressure regulator and shutoff valve and removing the source of control air upstream of the control switcher.

FED 801-815

C. Safety Features

If for any reason a thrust reverser sleeve leaves the stowed position in flight, the sleeve stow switch will close. In this condition, the arming solenoid and stow solenoid will be energized resulting in automatic actuation to the stowed position.

In flight malfunction of the thrust reverser system will only occur due to equipment failure or to reception of an improper deploy command signal in conjunction with an arming signal.
Equipment Failure
In the event of an air motor, splitter gearbox, master actuator, or flexshaft failure, the secondary locking feature built into the master actuators is designed to limit reverser sleeve driftback and preclude subsequent reverser deployment. Should the master actuator ballscrew move 1/8-inch out of the locking cam within the master actuator, the secondary locking mechanism automatically begins latching to prevent release of the secondary lock. Latching is complete at 1/2-inch of sleeve driftback travel at which time further system movement is prevented.

Although the aircraft reverser control system is designed to prevent receipt of an inadvertent in flight deploy command, a combination of multiple failures could result in reverser system deployment. An inadvertent reverser deployment inflight will be apparent by observation of appropriate reverser unlock light, and subsequent reverser deployment signals. In addition, the power for the affected engine would be returned to idle. Reverser in flight stow procedures under these circumstances are similar to those for landing stow operation of the reverser.

D. Thrust Reverser System Electrical Supply

FED 801-815
POST SB 78-2019 for A/C 801-815

C. Safety Features
If for any reason a thrust reverser sleeve leaves the stowed position in flight, the sleeve stow switch will close. In this condition, both synchronous shaft locks keep thrust reverser in stow position. In addition the arming solenoid and stow solenoid will be energized resulting in automatic actuation to the stowed position.

In flight malfunction of the thrust reverser system will only occur due to equipment failure or to reception of an improper deploy signal supplying synchronous shaft locks and selector valve deploy solenoid and removing power supply from selector valve stow solenoid in conjunction with an arming signal.

Equipment Failure
In the event of an air motor, splitter gearbox, master actuator, or main flexshaft failure, the transcowl driftback is precluded by engagement (inside synchronous shaft lock) of triangular rotor plate with either of the two pins. This prevents master actuator input shaft and ball screw from rotating and sleeve from deploying.

NOTE: Each synchronous shaft lock is capable on its own of retaining both sleeves in the fully stowed position against deployment loads.
In case of synchronous shaft lock failure, to lock the secondary locking feature built into the master actuators is designed to limit reverser sleeve driftback and preclude subsequent reverser deployment. Should the master actuator ballscrew move 1/8-inch out of the locking cam within the master actuator, the secondary locking mechanism automatically begins latching to prevent release of the secondary lock. Latching is complete at 1/2-inch of sleeve driftback travel at which time further system movement is prevented.

Although the aircraft reverser control system is designed to prevent receipt of an inadvertent in flight deploy command, a combination of multiple failures could result in reverser system deployment. An inadvertent reverser deployment inflight will be apparent by observation of appropriate reverser unlock light, and subsequent reverser deployment signals. In addition, the power for the affected engine would be returned to idle. Reverser in flight stow procedures under these circumstances are similar to those for landing stow operation of the reverser.

D. Thrust Reverser System Electrical Supply

FED 801–815
The reverser system supply within the general electrical system supply is detailed in (Ref. Fig. 016).

FED 801–815
POST SB 78–2019 for A/C 801–815
The reverser system supply within the general electrical system supply is detailed in (Ref. Fig. 017).

FED 801–815
The location of the relevant circuit breakers on the circuit breaker panel is shown in (Ref. Fig. 014).

FED 801–815
POST SB 78–2019 for A/C 801–815
The location of the relevant circuit breakers on the circuit breaker panel is shown in (Ref. Fig. 015).

FED 801–815
E. Electrical Control (described for engine 2)
(Ref. Fig. 018,021)
(1) **Deployment**

A command to deploy the thrust reverser closes the switch (14KM) which allows energization of the arming solenoid provided the main gear squat switch (16GB) is pressed (ground condition).

At the same time a second switch (8KM) is activated by the same command to energize the deploy solenoid. This is possible only with the other main gear squat switch (13GB) closed.

When the sleeves are out of the stowed position, stow switches close and REV UNLK amber warning comes on. The deploy switches remain in the stowed position while the reverser is deploying. When the reverser is nearly fully deployed, the deploy switches are tripped, the REV UNLK amber warning light goes off and REV green light comes on.

(2) **Stowage**

When the commanded switches (14KM and 8KM) are in the stow position after a stow order and when switch (16KM) is closed, the arming solenoid and the stow solenoid are energized.

The thrust reverser is actuated to the stowed position, with REV UNLK illuminated. When the sleeves reach the stowed position, sleeve stow switches open, this de-energizes the arming solenoid allowing the brake and locks of the actuation system to become operative.

If for any reason a thrust reverser sleeve leaves the stowed position in flight, the stow switch (S301 for RH sleeve or S307 for LH sleeve) closes. In this condition, the arming solenoid will be energized together with the stow solenoid by the corresponding relay and switch. The thrust reverser will be actuated to the stowed position.

(3) **Locking**

Two separate locking provisions are provided within the thrust reverser system. The primary means of holding the system stowed is provided by a brake in the pneumatic drive unit. Normally, it is spring-loaded in the brake applied position, preventing air motor rotation and resulting reverser translation. The brake is also applied to secure the system once the fully deployed position is reached. To release the brake, pressurization of the release chamber is required.

A system secondary locking feature is incorporated into each reverser master actuator. The master actuator locks function only in the reverser stowed position, guarding against reverser sleeve driftback in the event of an air
motor, splitter gearbox, master actuator or flexshaft failure.

During normal thrust reverse operation, the locks are released by pressurizing the lock actuator chambers. The thrust reverser master actuators contain cranking provisions to allow manual translation of the reverser sleeves. In order to accomplish this, the pneumatic drive unit primary brake and both of the master actuator secondary system locks must be manually released and held to allow sleeve movement.

FED 801-804, 806-811
POST SB 78-2019 for A/C 801-804, 806-811

E. Electrical Control (described for engine 2)
   (Ref. Fig. 020,023)

(1) Deployment
   A command to deploy (reverse throttle lever in the Rev Idle position) the thrust reverser closes the switch (14KM) which after 250 ms (time necessary for time delay relay 48KM (49KM) to close), allows energization of the arming solenoid provided the main gear squat switch (16GB) is pressed (ground condition).
   At the same time a second switch (8KM) is activated by the same reverse throttle command to energize the deploy solenoid and to supply the synchronous shaft lock solenoids to unlock the locks. This is possible only with the other main gear squat switches (13GB) and (19GB) closed.
   When the sleeves are out of the stowed position, stow switches close and REV UNLK amber warning comes on.
   The deploy switches remain in the stowed position while the reverser is deploying. When the reverser is nearly fully deployed, the deploy switches are tripped, the REV UNLK amber warning light goes off and REV green light comes on.
   As protection against a maintenance fault (rod/arm incorrect installation) the throttle control lever of the other engine has to be in a position below 22 degrees to cut off power supply to selector valve stow solenoid.

(2) Stowage
   When the commanded switches (14KM and 8KM) are in the stow position after a stow order and when switch (16KM) is closed, the arming solenoid and the stow solenoid are energized.
   The thrust reverser is actuated to the stowed position, with REV UNLK illuminated. When the sleeves reach the stowed position, sleeve stow switches open; this de-
energizes the arming solenoid allowing the brake and locks of the actuation system to become operative. Ten seconds after the stow command, the synchronous shaft locks lock again. If for any reason a thrust reverser sleeve leaves the stowed position in flight, the stow switch (S301 for RH sleeve or S307 for LH sleeve) closes. In this condition, the arming solenoid will be energized together with the stow solenoid by the corresponding relay and switch. The thrust reverser will be actuated to the stowed position.

(3) Locking

Three separate locking provisions are provided within the thrust reverser system. The primary means of holding the system stowed is provided by a brake in the pneumatic drive unit. Normally, it is spring-loaded in the brake applied position, preventing air motor rotation and resulting reverser translation. The brake is also applied to secure the system once the fully deployed position is reached. To release the brake, pressurization of the release chamber is required.

A system secondary locking feature is incorporated into each reverser master actuator. The master actuator locks function only in the reverser stowed position, guarding against reverser sleeve driftback in the event of failure of an air motor, splitter gearbox, master actuator, flexshaft or synchronous shaft lock. During normal thrust reverse operation, the locks are released by pressurizing the lock actuator chambers. The third locking system consists of two synchronous shaft locks (one lock per sleeve), installed between the master actuator and lower slave actuator, and connected to them through flexshafts. The synchronous shaft locks are permanently locked except during crew-commanded thrust reverser use. Upon selection of reverse thrust, the synchronous shaft locks are energized by the aircraft thrust reverser control system. The synchronous shaft locks remain energized and unlocked throughout the entire deploy cycle. The thrust reverser master actuators contain cranking provisions to allow manual translation of the reverser sleeves. In order to accomplish this, the pneumatic drive unit primary brake, both master actuator secondary system locks and both synchronous shaft locks must be manually released and held to allow sleeve movement.

FED 805,812-815
POST SB 78-2019 for A/C 805,812-815
E. Electrical Control (described for engine 2)  
(Ref. Fig. 019,022 )

(1) Deployment
A command to deploy (reverse throttle lever in the Rev Idle position) the thrust reverser closes the switch (14KM) which after 250 ms (time necessary for time delay relay 48KM (49KM) to close), allows energization of the arming solenoid provided the main gear squat switch (16GB) is pressed (ground condition). At the same time a second switch (8KM) is activated by the same reverse throttle command to energize the deploy solenoid and to supply the synchronous shaft lock solenoids to unlock the locks. This is possible only with the other main gear squat switch (13GB) and 19GB closed. When the sleeves are out of the stowed position, stow switches close and REV UNLK amber warning comes on. The deploy switches remain in the stowed position while the reverser is deploying. When the reverser is nearly fully deployed, the deploy switches are tripped, the REV UNLK amber warning light goes off and REV green light comes on. As protection against a maintenance fault (rod/arm incorrect installation) the throttle control lever of the other engine has to be in a position below 22 ° to cut off power supply to selector valve stow solenoid.

(2) Stowage
When the commanded switches (14KM and 8KM) are in the stow position after a stow order and when switch (16KM) is closed, the arming solenoid and the stow solenoid are energized. The thrust reverser is actuated to the stowed position, with REV UNLK illuminated. When the sleeves reach the stowed position, sleeve stow switches open; this de-energizes the arming solenoid allowing the brake and locks of the actuation system to become operative. Ten seconds after the stow command, the synchronous shaft locks lock again. If for any reason a thrust reverser sleeve leaves the stowed position in flight, the stow switch (S301 for RH sleeve or S307 for LH sleeve) closes. If both switches (S301 and S307) close, the arming solenoid will be energized together with the stow solenoid by the corresponding relay and switch. The Thrust reverser will be actuated to the stowed position.

(3) Locking
Three separate locking provisions are provided within the thrust reverser system. The primary means of holding the
System stowed is provided by a brake in the pneumatic drive unit. Normally, it is spring-loaded in the brake applied position, preventing air motor rotation and resulting reverser translation. The brake is also applied to secure the system once the fully deployed position is reached. To release the brake, pressurization of the release chamber is required.

A system secondary locking feature is incorporated into each reverser master actuator. The master actuator locks function only in the reverser stowed position, guarding against reverser sleeve driftback in the event of failure of an air motor, splitter gearbox, master actuator, flexshaft or synchronous shaft lock. During normal thrust reverse operation, the locks are released by pressurizing the lock actuator chambers. The third locking system consists of two synchronous shaft locks (one lock per sleeve), installed between the master actuator and lower slave actuator, and connected to them through flexshafts. The synchronous shaft locks are permanently locked except during crew-commanded thrust reverser use. Upon selection of reverse thrust, the synchronous shaft locks are energized by the aircraft thrust reverser control system. The synchronous shaft locks remain energized and unlocked throughout the entire deploy cycle. The thrust reverser master actuators contain cranking provisions to allow manual translation of the reverser sleeves. In order to accomplish this, the pneumatic drive unit primary brake, both master actuator secondary system locks and both synchronous shaft locks must be manually released and held to allow sleeve movement.

**FED 801-815**

F. Indicating
   (Ref. Fig. 024,025)
   Two annunciator lights located in the flight compartment provide indication on the thrust reverser configuration. As soon as any of brake or secondary lock or stow switch is open, the fan reverser configuration is indicated by REV UNLK warning light illumination. The above warning is replaced by illumination of REV indicator light showing that the thrust reverser is fully deployed as soon as deploy switch is open. No indication is on when the translating sleeve is fully stowed. In addition, the signal sent from the FADEC to the ECAM system provides indication of the sleeves position on the CRT (Ref. Fig. 026).

**FED 801-815**
POST SB 78-2019 for A/C 801-815

F. Indicating
(Ref. Fig. 024,025 )
Two annunciator lights located in the flight compartment provide indication on the thrust reverser configuration. As soon as any of brake or secondary lock or stow switch is open, the fan reverser configuration is indicated by REV UNLK warning light illumination. The above warning is replaced by illumination of REV indicator light showing that the thrust reverser is fully deployed as soon as deploy switch is open. No indication is on when the translating sleeve is fully stowed. In addition, the signal sent from the FADEC to the ECAM system provides indication of the sleeves position on the CRT (Ref. Fig. 026 ). There is no indication in the flight compartment associated with the synchronous shaft locks.

FED 801-815

G. Throttle Control Feedback
(Ref. Fig. 027,028,030 )
The master actuator of each thrust reverser duct half incorporates a feedback mechanism which provides reverser position feedback to the FADEC. This mechanism consists of a self-contained dual rotary variable differential transformer (RVDT) (see detailed description in paragraph H. and I.), integral reduction gearing and mechanically activated electrical switches for stow and deploy indication, which attach to the thrust reverser master actuators (two off) at the mechanical feedback gear drive pad. Both RVDT output signals are wired to both A & B channels of the FADEC. In addition, the FADEC receives throttle lever resolver signals, according to throttle control lever position. As the reverser translates through deploy and stow, each master actuator internal gearbox drives an RVDT in direct relation to translating sleeve travel. The RVDT provides an electrical signal feedback via an electrical harness to the FADEC (Ref. Fig. 028 ). In reverser deploy command, (Ref. Fig. 027 ) the FADEC software logic maintains an approach idle fuel flow setting until a signal indicating 78% of full deployment is received. Maximum reversing fuel flow cannot be attained until 90% of full deployment is indicated (Ref. Fig. 030 ). In reverser stow command (Ref. Fig. 027 ), the FADEC software logic maintains idle fuel flow until an 85% stowed indication is received. Maximum forward power cannot be attained until a 90% stowed signal is received.
(Ref. Fig. 030). Should an uncommanded deploy occur, the FADEC will command idle fuel flow regardless of throttle position (Ref. Fig. 030).

FED 801-815
POST SB 78-2019 for A/C 801-815

G. Throttle Control Feedback
(Ref. Fig. 027,029,030)
The master actuator of each thrust reverser duct half incorporates a feedback mechanism which provides reverser position feedback to the FADEC. This mechanism consists of a self-contained dual rotary variable differential transformer (RVDT) (see detailed description in paragraph H. and I.), integral reduction gearing and mechanically activated electrical switches for stow and deploy indication, which attach to the thrust reverser master actuators (two off) at the mechanical feedback gear drive pad. Both RVDT output signals are wired to both A & B channels of the FADEC. In addition, the FADEC receives throttle lever resolver signals, according to throttle control lever position. As the reverser translates through deploy and stow, each master actuator internal gearbox drives an RVDT in direct relation to translating sleeve travel. The RVDT provides an electrical signal feedback via an electrical harness to the FADEC (Ref. Fig. 029).

In reverser deploy command, (Ref. Fig. 027) the FADEC software logic maintains an approach idle fuel flow setting until a signal indicating 78% of full deployment is received. Maximum reversing fuel flow cannot be attained until 90% of full deployment is indicated (Ref. Fig. 030).

In reverser stow command (Ref. Fig. 027), the FADEC software logic maintains idle fuel flow until an 85% stowed indication is received. Maximum forward power cannot be attained until a 90% stowed signal is received (Ref. Fig. 030). Should an uncommanded deploy occur, the FADEC will command idle fuel flow regardless of throttle position (Ref. Fig. 030).

FED 801-815

H. Rotary Variable Differential Transformer (RVDT)
(Ref. Fig. 031,032,033)
The RVDT provides a signal to the FADEC which is proportional to actuator percent deployed. The zero percent deployed position is equivalent to the actuator fully stowed on its stops. The 100 percent deployed position corresponds to 20.84
in. (529.3 mm) of actuator stroke. The RVDT assembly also contains limit switches which indicate stowed and deployed position and also control the arming solenoid of the pressure regulator and shutoff valve. One RVDT/switch assembly is mounted on each right and left master actuator. The unit operates as described when mounted on the master actuator gearbox (Ref. Fig. 033). The RVDT is a dual unit to accommodate channel A and B inputs to the FADEC. For each channel, the primary (input) coils of the left and right units are wired in parallel and the secondary (output) coils are wired in series (Ref. Fig. 033).

I. Stow and Deploy Switches
A stow switch for each reverser half is set such that the switch contacts close between 0.150 in. and 0.300 in. (3.81 mm and 7.62 mm) of actuator stroke as the reverser is deployed. The switch contacts open between 0.500 in. and 0.150 in. (12.70 mm and 3.81 mm) from stow as the reverser is stowed. A deploy switch for each reverser half contact closes at 95 percent ±2 of the deployed position as the reverser deploys. When the reverser stows, the contacts open at or before 90 percent of the deployed position.

FED 801-815
POST SB 78-2019 for A/C 801-815

J. Synchronous shaft Lock
(1) Description
The thrust reverser synchronous shaft lock system on each engine consists of an electric synchronous shaft lock (sync lock) on each T/R sleeve and the wiring harness containing the synchronous shaft lock solenoid command wiring. The system includes associated brackets and clips to secure the locks and wiring harnesses to the engine and T/R. The fan cowl doors also incorporate adhesively bonded metallic skid plates that protect the composite structure in the event that the manual unlock lever is not returned to the locked position after maintenance. The synchronous shaft locks are installed in the actuation system of each T/R half. The synchronous shaft locks are bracket-mounted to the T/R torque box between the master actuators and the lower slave actuators. Each synchronous shaft lock interfaces with the actuation system through two flexshafts: one flexshaft interconnects between the slave actuator and the synchronous shaft lock and the second flexshaft. 
interconnects between the synchronous shaft lock and the master actuator.
The wiring harness starts at connector number D4970P at the fan area pylon interface and terminates in connectors at each synchronous shaft lock.

(2) Operation
(Ref. Fig. 034,035)
The synchronous shaft lock is a solenoid-operated unit which in the normal, de-energized state, prevents T/R operation. The synchronous shaft lock incorporates an internal rotor with a three-lobed rotor plate near one end. In the locked state, the rotor plate is prevented from rotation by two lock pins that block rotation of the rotor plate. The interconnecting flexshafts interface with the rotor such that the flexshafts are inhibited from rotation if the synchronous shaft lock is locked. When energized, the solenoid pulls in the solenoid armature which simultaneously pulls the lock pins out of the path of rotation of the rotor plate thereby allowing T/R operation. In the event of system failures resulting in an uncommanded deploy such that the PDU is outputting full stall torque, each synchronous shaft lock is capable on its own of retaining both thrust reverser sleeves in the stowed position.

(3) Manual unlock lever
(Ref. Fig. 036,037)
In order to manually deploy the T/R for maintenance work, both synchronous shaft locks must be unlocked. Each synchronous shaft lock has a manual unlock lever that, when rotated, mechanically moves the solenoid armature to the unlock position, pulling the lock pins clear of the rotor plate. The manual unlock lever is held in either the normal or unlocked position by a ball detent at the base of the lever. In the event that the manual unlock lever is not returned to the normal position after maintenance, closure of the fan cowl door will push the lever to the normal position thus assuring dispatch with the synchronous shaft lock properly locked.
Figure 001
Figure 001. Throttle Control Handle Thrust Reverser (Sheet 1)
Figure 002

Figure 002. Throttle Control Handle Thrust Reverser  (Sheet 1)
Figure 003

Figure 003. Thrust Reverser System – Component Location (Sheet 1)
Figure 004
Figure 004. Thrust Reverser System - Component Location (Sheet 1)
Figure 005

Figure 005. Thrust Reverser System - Component Location  (Sheet 1)
Figure 006

Figure 006. Thrust Reverser System - Component Location (Sheet 1)
Figure 007

Figure 007. Thrust Reverser Actuation System - Deploy Mode  (Sheet 1)
Figure 008

Figure 008. Thrust Reverser Actuation System – Deploy Mode  (Sheet 1)
Figure 009

Figure 009. Thrust Reverser Actuation System - Stow Mode (Sheet 1)
Figure 010

Figure 010. Thrust Reverser Actuation System – Stow Mode (Sheet 1)
Figure 011

Figure 011. Pressure Regulating and Shut off Valve (Sheet 1)
Figure 012
Figure 012. Pneumatic Drive Unit (Sheet 1)
Figure 013
Selector Valve (Sheet 1)
Figure 014

Figure 014. Circuit Breakers - Location (Sheet 1)
Figure 015
Figure 015. Circuit Breakers - Location (Sheet 1)
Figure 016

Figure 016. Thrust Reverser System - Electrical Supply  (Sheet 1)
Figure 017

Figure 017. Thrust Reverser System - Electrical Supply  (Sheet 1)
Figure 018. Thrust Reverser Control and Indicating, ENG2 Aircraft on Ground, No Electrical Power (Sheet 1)
Figure 019

Figure 019. Thrust Reverser Control and Indicating, ENG2 Aircraft on Ground, No Electrical Power (Sheet 1)
Figure 020

Figure 020. Thrust Reverser Control and Indicating, ENG2 Aircraft on Ground, No Electrical Power (Sheet 1)
Figure 021
Figure 021. Thrust Reverser Control and Indicating, ENG1 Aircraft on Ground, No Electrical Power (Sheet 1)
Figure 022

Figure 022. Thrust Reverser Control and Indicating, ENG1 Aircraft on Ground, No Electrical Power (Sheet 1)
Figure 023

Figure 023. Thrust Reverser Control and Indicating, ENG1 Aircraft on Ground, No Electrical Power (Sheet 1)
Figure 024

Figure 024. Thrust Reverser Indicating (Sheet 1)
### Deploy/Stow Cycle - Indicating

<table>
<thead>
<tr>
<th>OPERATION</th>
<th>REVERSER UNLOCK (AMBER)</th>
<th>REVERSER THRUST (GREEN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEPLOY CYCLE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. PRIOR TO SELECTION OF DEPLOY</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>2. A. MASTER ACTUATORS UNLOCKED</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>B. PDU UNLOCKED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. STOW SWITCHES DE-ACTUATED</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>4. DEPLOY SWITCHES ACTUATED</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>STOW CYCLE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. DEPLOY SWITCHES DE-ACTUATED</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>6. STOW SWITCHES ACTUATED</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>7. CENTER ACTUATORS LOCKED</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Figure 025**

Figure 025. Deploy/Stow Cycle - Indicating (Sheet 1)
FED 801-815

Figure 026
Figure 026. RECAM Display unit - GND TEST (Sheet 1)
Figure 027

Figure 027. FADEC Interface with Thrust Reverser  (Sheet 1)
Figure 028

Figure 028. Thrust Reverser System Block Diagram (Sheet 1)
Figure 029
Figure 029. Thrust Reverser System Block Diagram  (Sheet 1)
Figure 030

Figure 030. Thrust Limiting During Reverser Transition (Sheet 1)
Figure 031
Figure 031. RVDT Location (Sheet 1)
Figure 032

Figure 032. RVDT Feedback Module - Schematic (Sheet 1)
Figure 033
Figure 033. RVDT Electrical Wiring (Sheet 1)
Figure 034
Figure 034. Synchronous Shaft Lock (Sheet 1)
Figure 035

Figure 035. Synchronous Shaft Locking Concept (Sheet 1)
**Figure 036**

**Figure 036. Manual Unlock Lever – Normal Position**  (Sheet 1)
Figure 037. Manual Unlock Lever - Unlocked Position (Sheet 1)