tellabs
technical manual
76-816205
rev A

practice section 816205


# 6205 AIOD Converter (SX-E&M) Module

**contents**



## 1. general description

1.01 The 6205 AIOD Converter (SX-E&M) module (figure 1) is a simplex-to-E&M signaling converter used in Automatically Identified Outward Dialing (AIOD) PBX applications. Specifically, the 6205 converts simplex supervision at a common-control PBX to 4wire E&M signaling for transmission of station-identification information to Automatic Message Accounting (AMA) equipment at a distant central office. The 6205, usually located at the PBX's serving CO, serves one circuit. The 6205 is functionally equivalent to a Western Electric Co. SD-99446-01 Signaling Converter Circuit.

1.02 In the event that this Practice is reissued, the reason for reissue will be stated in this paragraph.

1.03 Features, functions, and options of the 6205 include an integral repeat coil (with provision for use of an external coil if desired), switch-selectable 600 or 900-ohm impedance matching toward the facility, and optional simplex-current limiting for short PBX-CO circuits.

1.04 The 6205's integral repeat coil terminates the PBX AIOD data loop and derives the local simplex lead. The repeat coil may be optioned out of the circuit if use of an external coil is preferred. When optioned into the circuit, the repeat coil provides either 600 or 900-ohm balanced terminating impedance on the facility side. Terminal-side impedance (toward the PBX AIOD data loop) is fixed at 900 ohms, balanced. The 6205 provides idle-line termination.

1.05 Front-panel LED's light to indicate E-lead and M-lead busy status. A third front-panel LED lights when the module is in the test mode (see paragraph 2.04).

1.06 The 6205 operates on −44 to −56Vdc filtered battery. Maximum current requirement is 90mA (plus M-lead current) when busy.

1.07 The 6205 mounts in one position of a Tellabs Type 10 Mounting Shelf, versions of which are available for relay rack or apparatus case installation. In relay rack applications, up to 12 modules can be mounted across a 19-inch rack, while up to 14 modules can be mounted across a 23-inch rack. In either case, 6 inches of vertical rack space is used.

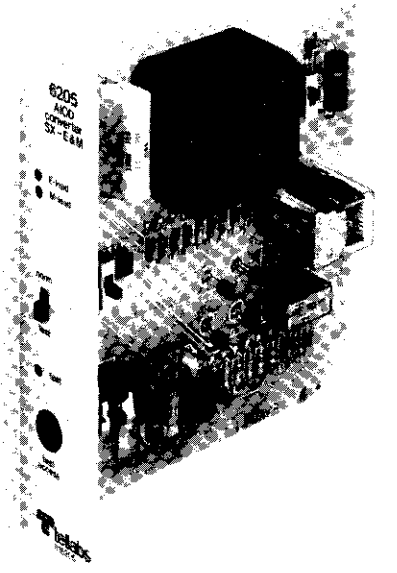


*figure 1. 6205 AIOD Converter (SX-E&M) module*

## 2. application and operation

### general application

2.01 The 6205 AIOD Converter module is used to extend PBX AIOD access to AMA equipment in a distant central office. When AMA equipment is located in the central office serving the PBX, signal-conversion equipment is not usually required (see figure 2). When the local CO cannot accommodate AIOD service, however, access to an AMA register is extended to a larger office. This extension may be via a carrier-derived E&M voice channel, PCM carrier, SF signaling, or, on rare occasions, DX facilities. The 6205 provides conversion between the PBX-CO loop's simplex supervision and a 4wire E&M interface. Figure 3 shows one typical application of the 6205.

2.02 The 6205 responds to PBX seizure of the PBX AIOD data loop by changing the state of the local M lead from ground (idle) to battery potential. This information is sent to the distant AMA register to indicate incoming data transmission. When the AMA digit register is connected to the data loop, a clear-to-send signal grounds the 6205's E lead, and the 6205 converts this to the appropriate simplex supervisory state. The PBX responds by transmitting station-identification information as frequency-shift-keying (FSK) or phase-shift-keying (PSK) voice-band data. When the PBX completes this data transmission, the simplex-lead state changes to idle and the 6205 grounds the local M lead. When the AMA digit register releases, the 6205's E lead opens, and the simplex lead returns to its original idle state.

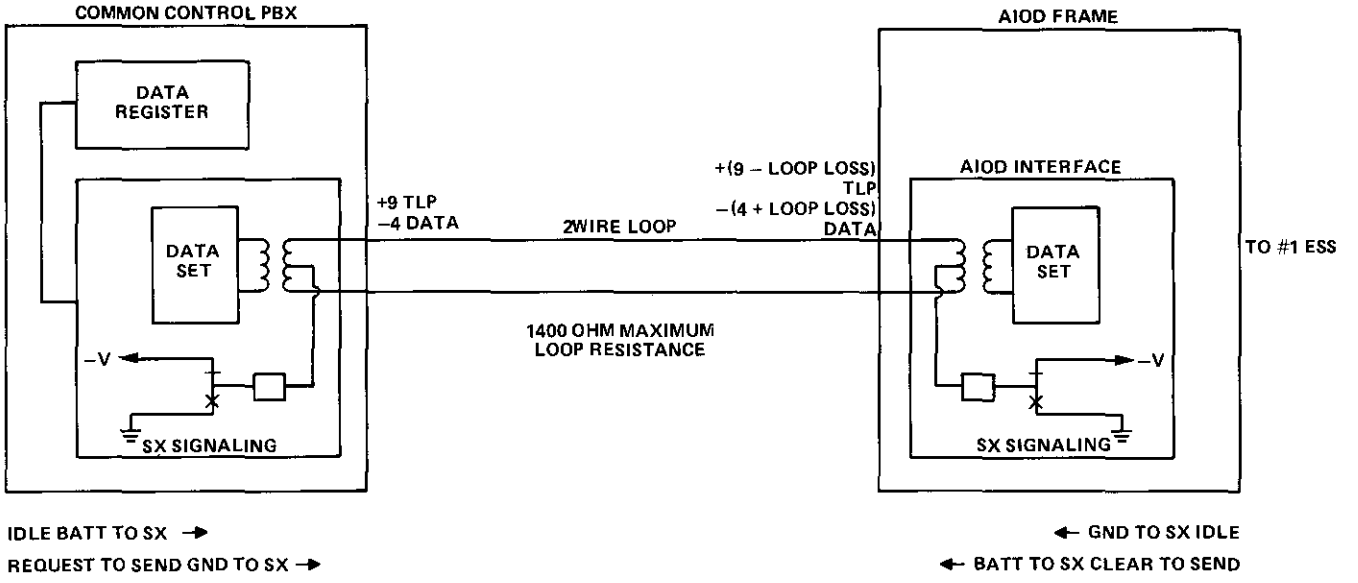



*figure 2. Typical local AIOD arrangement*

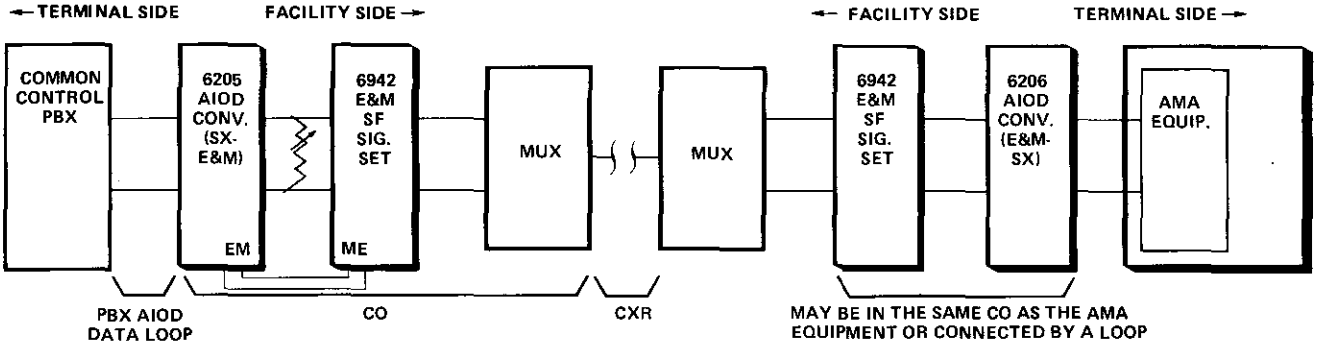



*figure 3. Typical 6205 application*

**repeat coil and level coordination**

2.03 The 6205 can be switch-optioned to place its integral repeat coil in the PBX AIOD data loop, providing impedance matching and a simplex lead. The module's integral repeat coil does not, however, provide level control. (The insertion loss provided by the coil is approximately 0.4dB at 1000Hz.) To provide level control between the PBX AIOD data loop and the receive input port of the carrier unit, an external attenuator (e.g., a Tellabs 4401, 4402, 4403, or 4404 Pad/Transformer module) must be used.

**testing**

2.04 A front-panel *test access* jack provides access to the local simplex lead via its ring contact (the tip contact is unused). A 310 plug in the *test access* jack allows monitoring of simplex operation when the module's *norm/test* switch is set for normal operation. In the test mode (i.e., when the switch is set to the *test* position), however, this connection is opened for seizure or testing when a plug is inserted into the *test access* jack. Also, a 1000-ohm resistor is inserted between the simplex lead and ground to maintain an idle-circuit indication toward the PBX. The front-panel *test* LED lights when the module is in the test mode.

**operation**

*The remainder of section 2 discusses operation of the 6205 in a typical application. Figure 4 shows the simplex and E&M states involved in such applications. Keep in mind that at the distant end of the circuit, similar signaling-state changes will take place, possibly via a Tellabs 6206 AIOD (E&M-SX) Converter module (see figure 3).*

**idle**

2.05 In the idle state, the PBX applies battery potential to the simplex lead at its end of the AIOD data loop. The E lead of the 6205, under control of the AMA equipment at the distant end, is open. The *E-lead* and *M-lead* LED's are not lit, and an idle-line termination is connected across the transmission pair.

**seizure**

2.06 The PBX requests seizure of the AMA digit register by removing battery potential and connecting ground to its simplex lead. (Seizure is never initiated in the reverse direction.) The 6205 then changes its M-lead output from ground to battery potential and removes the idle-line termination. When the AMA digit register recognizes the seizure signal, the 6205 receives a ground on the E lead. The 6205 responds by removing the simplex ground

potential and applying battery. The PBX recognizes this as an indication that a digit register is attached and proceeds to send its station-identification information to the AMA equipment. As data is transmitted, both the *E-lead* and *M-lead* LED's on the 6205 are lit.

**disconnect**

2.07 When the PBX completes transmission of its station-identification data, it removes ground from its simplex lead and connects resistance battery to the lead. The 6205 responds to this supervisory change by changing its M-lead potential from battery to ground. No further action takes place until the AMA digit register releases and the 6205's E lead changes from ground to open. (Control logic in the 6205 prevents reseizure of the digit register until a valid register-release indication is received from the AMA equipment.) The 6205 responds by changing its simplex-lead potential from battery to ground and resets the reseizure prevention logic. The circuit is then idle. Circuit supervisory states are summarized in table 1.

| supervisory state | PBX SX state | CO SX state | M lead | E lead |
|---|---|---|---|---|
| idle | battery | ground | ground | open |
| request for service | ground | ground | battery | open |
| request ack. | ground | battery | battery | ground |
| PBX release | battery | battery | ground | ground |
| AMA release | battery | ground | ground | open |

**Note:** *All battery states are through a resistance.*

*table 1. Circuit supervisory states*

## 3. installation

**inspection**

3.01 The 6205 AIOD Converter module should be visually inspected upon arrival in order to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the module should be visually inspected again prior to installation.

**mounting**

3.02 The 6205 mounts in one position of the Tellabs Type 10 Mounting Shelf, which is available in configurations for both relay rack and apparatus case installation. The module plugs physically and electrically into a 56-pin connector at the rear of the Type 10 Shelf.

**installer connections**

3.03 Before making any connections to the mounting shelf, make sure that power is **off** and modules are **removed.** Modules should be put into place only **after** they are properly optioned and **after** wiring is completed.

3.04 Tables 2 and 3 list external connections to the 6205 module. All connections are made via wire-wrapping at the 56-pin connector at the rear of the module's mounting shelf position. Pin numbers are found on the body of the connector. Table 2 lists connections when the module's *integral* repeat coil is used. Table 3 lists connections when an *external* repeat coil is used.

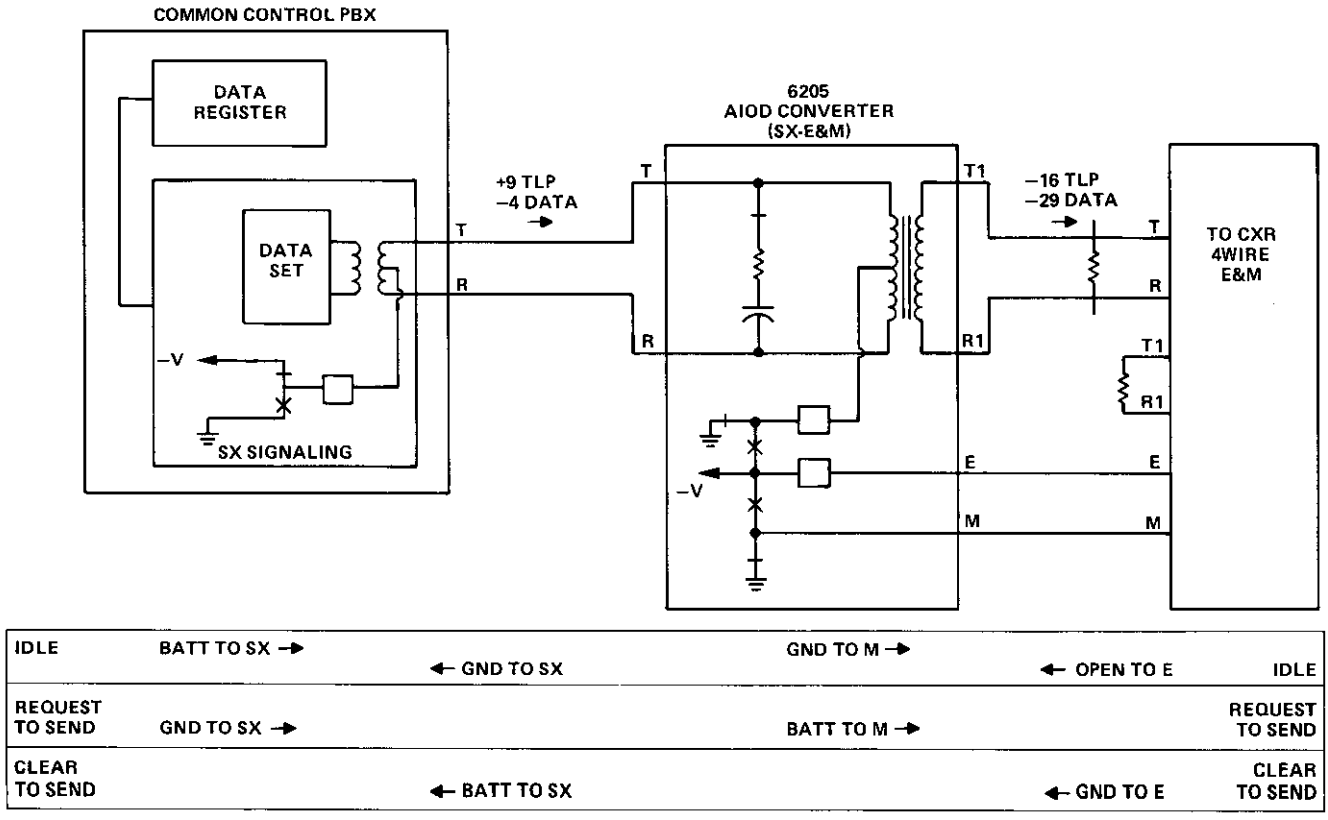



*figure 4. Simplex and E&M states in a typical 6205 application*

| connect: | to pin: |
|---|---|
| T (PBX-loop tip) | 41 |
| R (PBX-loop ring) | 49 |
| T1 (AMA-register tip) | 51 |
| R1 (AMA-register ring) | 33 |
| M LEAD | 45 |
| E LEAD | 11 |
| –BATT (–48dc CO battery) | 35 |
| GND (ground) | 17 |

*table 2. Installer connections (integral repeat coil)*

| connect: | to pin: |
|---|---|
| T (PBX-loop tip) | 41 |
| R (PBX-loop ring) | 49 |
| T AUX | 53 |
| R AUX | 13 |
| SX | 47 |
| M LEAD | 45 |
| E LEAD | 11 |
| –BATT (–48Vdc CO battery) | 35 |
| GND (ground) | 17 |

*table 3. installer connections (external repeat coil)*

**option selection**

3.05 Four option switches (all of which are two-position slide switches) must be set before the 6205 is placed into service. Three of these switches are located on the printed circuit board as shown in figure 5. The fourth switch is the *norm/test* switch on the module's front panel (see paragraph 2.04). Paragraphs 3.06 through 3.09 describe each switch in detail.

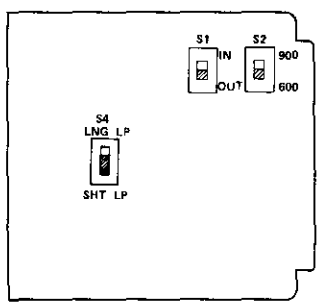



*figure 5. 6205 switch options*

3.06 Option switch *S1* conditions the module for use with either an internal or external repeat coil. Set *S1* to the *IN* position if the module's integral repeat coil is used, and wire the module as shown in table 2. Set *S1* to the *OUT* position if an external repeat coil is used, and wire the module as shown in table 3.

3.07 Switch *S2* selects either 600 or 900-ohm terminating impedance on the facility side of the 6205. Set *S2* to the *600* or *900* position as required.

3.08 Switch *S3* is the front-panel *norm/test* switch. Set *S3* to the *norm* position for normal circuit operation. Set *S3* to the *test* position for direct access to the simplex lead through the front-panel *test access* jack.

3.09 Switch *S4* is used to add resistance to the simplex path in short-loop applications. Set *S4* to the *SHT LP* (short loops) position when the AIOD data loop has less than 1000 ohms of dc resistance between the PBX and the 6205 module. The *SHT LP* setting provides approximately 1100 ohms of dc resistance. Set *S4* to the *LNG LP* (long loops) position when total loop resistance is greater than 1000 ohms. The *LNG LP* setting provides approximately 620 ohms of dc resistance.

**Note:** *The 6205's supervisory range is not appreciably affected by the setting of switch* S4. *The simplex-current detector in the 6205 is sufficiently sensitive to detect current beyond CO loop-supervisory limits. The switch is provided simply as a means of limiting simplex current on short PBX-CO circuits.*

3.10 No alignment of the 6205 is required. However, any associated level-control device should be aligned before the module is put into service.

## 4. circuit description

4.01 This circuit description is intended to familiarize you with the 6205 AIOD Converter module for engineering and application purposes only. Attempts to troubleshoot the module internally are not recommended. Such procedures should be limited to those prescribed in section 7 of this Practice. Please refer to the 6205 Block Diagram, section 5 of this Practice, as an aid in following the circuit description.

**Note:** *The following circuit description presumes use of the 6205's integral repeat coil rather than an external repeat coil.*

4.02 The analog data path through the 6205 includes an impedance-matching transformer, *T1*, that derives either 600 or 900-ohm balanced impedance on the facility (CO) side and fixed 900-ohm impedance on the terminal (PBX) side. The transformer primary (terminal side) is center-tapped to derive a simplex (SX) lead through which supervisory currents are introduced and detected.

4.03 The *SX current detector* in the 6205 consists of a pair of oppositely poled opto-couplers that detect the direction of current flow through the simplex path. Either the absence of simplex current or simplex current from the PBX toward the CO (i.e., either the seizure or busy condition) activates the *K1 relay* control circuit, which operates relay *K1*. Relay *K1*, the M-lead relay, grounds the M lead when it is released and provides resistance battery on the M lead when it is operated.

4.04 A second relay in the 6205, *K2*, senses the state of the local E lead input. Relay *K2* is operated when the E lead is grounded and is released when the E lead is open. Contacts of relay *K2* establish the simplex-lead potential at the CO. When *K2* is operated, the CO simplex lead is connected to resistance battery. When *K2* is released, the CO simplex lead is grounded. Contacts of both relays are used in the *K1 relay control* circuit to prevent reoperation of *K1* after a disconnect until relay *K2* has released (reseizure prevention).

4.05 The 6205 uses positive-temperature-coefficient current-limiting varistors in both the M-lead path and the simplex-current path. These *current limiters* limit current to less than 100mA under all external circuit conditions.

4.06 An idle-circuit termination is provided between the PBX-loop tip and ring leads. The termination is inserted whenever relay *K1* is released and is removed when the relay is activated. The terminating impedance is 900 ohms in series with 2.0μF capacitance.

4.07 Power to the 6205 is provided via normal −48Vdc central office battery. A diode in the power input path provides reverse-battery protection, and a metal-oxide varistor provides voltage transient protection for internal circuitry.

## 6. specifications

### transmission parameters

*insertion loss*
**0.3 to 0.5dB at 1000Hz between 900-ohm source and 600 or 900-ohm load**

*frequency response*
**±0.2dB re 1000Hz level, 500 to 4000Hz**
**±0.5dB re 1000Hz level, 300 to 4000Hz**

*port impedances*
**PBX side: 900 ohms nominal, balanced**
**CO side: 600 or 900 ohms ±10%, balanced, switch-selectable**

*envelope delay distortion*
**less than 50 microseconds for any pair of frequencies between 500 and 3000Hz**

*maximum signal level*
**greater than +10dBm**

### supervisory parameters

*simplex supervisory range*
**0 to greater than 5000 ohms dc resistance**

*SX resistance*
**short loops – 1000 ±100 ohms**
**long loops – 600 ±50 ohms**
**(Does not include resistance of current-limiting varistor in SX path when K2 relay is operated. The resistance of this device is nominally 65 ohms at low levels of SX current and several kilohms with an external short.)**

*E-lead sensitivity*
**maximum 200 ohms dc resistance to ground**

*supervisory timing*
**seizure from PBX: 25 ±10ms**
**release from PBX: 25 ±10ms**
**E-lead seizure delay: 5 ±3ms**
**E-lead release delay: 10 ±3ms**

### physical

*power requirements*
**input voltage: −44 to −56Vdc, filtered, ground-referenced**

*current requirements*
**idle: 10mA**
**seizure from PBX: 50mA plus external M-lead current**
**local busy: 60mA plus M-lead & SX current**

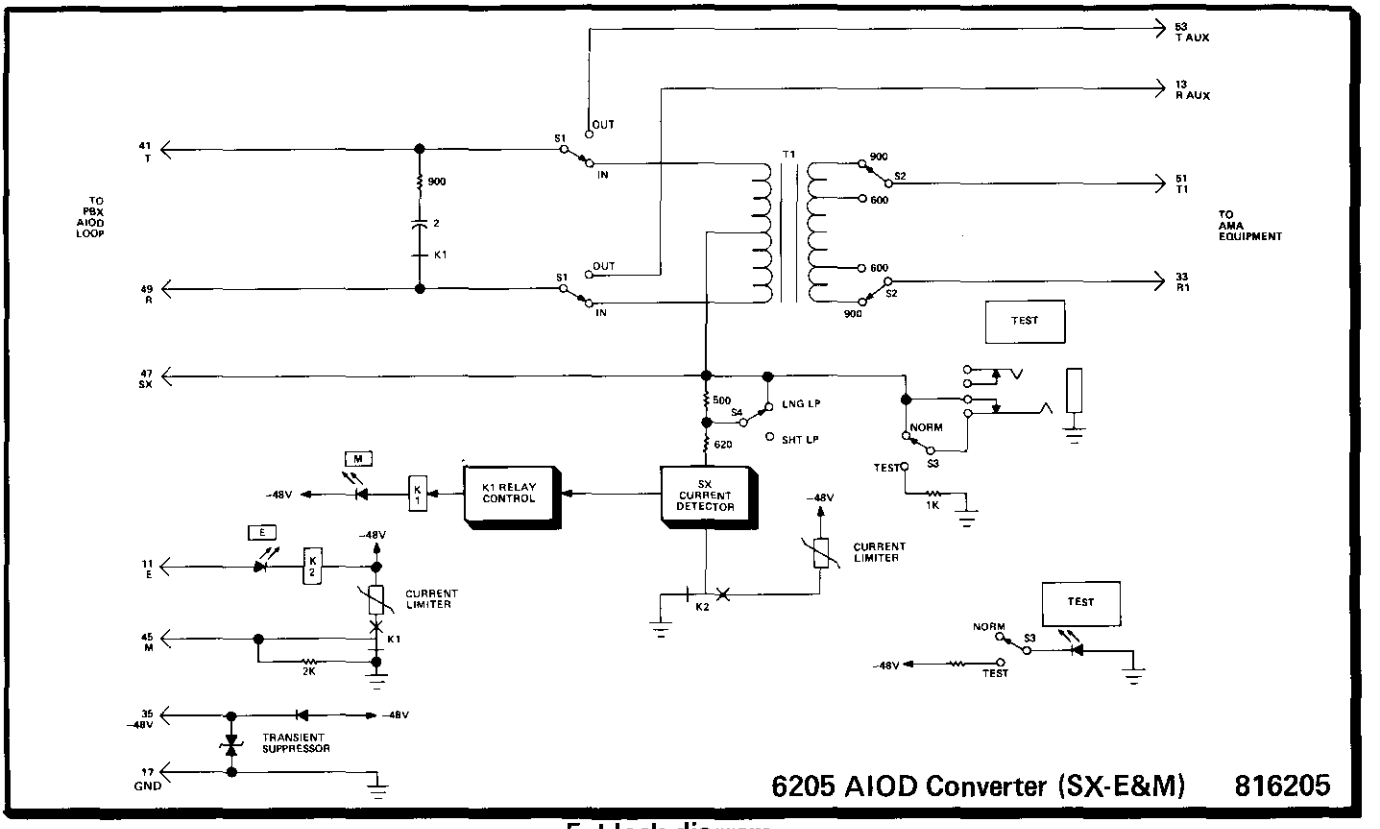
*front-panel LED's*
**M-lead busy, E-lead busy, test mode active**

*operating environment*
**20° to 130°F (−7° to 54°C), humidity to 95% (no condensation)**

*dimensions*
**5.58 inches (14.17cm) high**
**1.42 inches (3.61cm) wide**
**5.96 inches (15.14cm) deep**

*weight*
**16 ounces (454 grams)**

*mounting*
**relay rack or apparatus case via one position of Tellabs Type 10 Mounting Shelf**




5. block diagram

## 7. testing and troubleshooting

7.01 The Testing Guide Checklist in this section may be used to assist in the installation, testing, or troubleshooting of the 6205 AIOD Converter (SX-E&M) module. The Checklist is intended as an aid in the localization of trouble to a specific module. If a module is suspected of being defective, a new one should be substituted and the test conducted again. If the substitute module operates correctly, the original module should be considered defective and returned to Tellabs for repair or replacement. We strongly recommend that no internal (component-level) testing or repairs be attempted on the 6205 module. Unauthorized testing or repairs may void the module's warranty.

7.02 If a situation arises that is not covered in the Checklist, contact Tellabs Customer Service at your Tellabs Regional Office or at our Lisle or Mississauga Headquarters. Telephone numbers of the regional offices are as follows:

central: (314) 625-8800
northeast: (412) 787-7860
southeast: (305) 645-5888
western: (213) 595-7071

7.03 If a 6205 is diagnosed as defective, the situation may be remedied by either *replacement* or *repair and return*. Because it is more expedient, the *replacement* procedure should be followed whenever time is a critical factor (e.g., service outages, etc.)

**replacement**

7.04 To obtain a replacement 6205 module, notify Tellabs via letter (see below), telephone ((312) 969-8800 in the USA, (416) 624-0052 in Canada), or twx (910-695-3530). Be sure to provide all relevant information, including the 816205 part number that indicates the issue of the module in question. Upon notification, we shall ship a replacement module to you. If the module in question is in warranty, the replacement will be shipped at no charge. Pack the defective 6205 in the replacement module's carton, sign the packing slip included with the replacement module, and enclose it with the defective module (this is your return authorization). Affix the preaddressed label provided with the replacement module to the carton being returned, and ship the module prepaid to Tellabs.

**repair and return**

7.05 Return the defective 6205 module, shipment prepaid, to Tellabs (attn: repair and return).

in the USA: Tellabs Incorporated
4951 Indiana Avenue
Lisle, Illinois 60532

in Canada: Tellabs Communications Canada, Ltd.
1200 Aerowood Drive, Unit 11
Mississauga, Ontario, Canada L4W 2S7

Enclose an explanation of the module's malfunction. Follow your company's standard procedure with regard to administrative paperwork. Tellabs will repair the module and ship it back to you. If the module is in warranty, no invoice will be issued.

## testing guide checklist

**Note:** *Proper operation of the 6205 can be determined by performing tests via the front-panel test access jack and the local E lead. To avoid seizure of the AMA digit register during testing, it is recommended that E-lead and M-lead connections between the 6205 and the local signaling equipment be opened during these tests.*

| test | test procedure | normal result | if normal conditions are not met, verify: |
|---|---|---|---|
| circuit idle | Set front-panel *norm/test* switch to *test* position and insert test cord with 310-type plug into *test access* jack. Connect CO battery to ring of test cord. | Front-panel *test* LED lighted ☐. *E-lead* and *M-lead* LED's extinguished ☐. | Power properly connected ☐. E lead open ☐. |
| PBX seizure | Remove battery from test-cord ring and connect CO ground to test-cord ring. Observe E-lead and M-lead LED's. | *M-lead* LED lighted (M lead at CO battery potential) ☐. *E-lead* LED extinguished ☐. | Replace module and retest ☐. |
| digit register seized | Apply ground to E-lead input to 6205 (pin 11). | *E-lead* LED lighted ☐. | Replace module and retest ☐. |
| | Remove ground from test-cord ring and connect VOM (50Vdc scale) between test cord ring and ground (pin 17). | *M-lead* LED extinguished ☐. VOM reads −48 ±6Vdc ☐. | E lead at ground ☐. Replace module and retest ☐. |
| reseizure prevention | Remove VOM from test-cord ring and apply ground to test-cord ring. | *M-lead* LED remains unlighted ☐. *E-lead* LED lighted ☐. | E lead at ground ☐. Replace module and retest ☐. |
| release | Remove ground from test-cord ring. Remove E-lead ground from pin 11. | Both *E-lead* and *M-lead* LED's extinguished ☐. | Replace module and retest ☐. |
| transmission | Reapply ground to test-cord ring; then ground E lead. Arrange transmit portion of TMS to output 1000Hz test tone at 0dBm and at 900 ohms. Insert this signal at connector pins 41 and 49. Condition TMS for appropriate terminating impedance and measure the signal level at pins 51 and 33. | Both *E-lead* and *M-lead* LED's lighted ☐. TMS indicates 0.3 ±0.2dBm ☐. | Switch *S1* set to *IN* ☐. Switch *S2* set to *600* or *900* as appropriate ☐. |
| | Return *S3* to *norm*. Remove test cord and E-lead ground. | All LED's extinguished ☐. | |