tellabs
technical manual
76-827011
rev A

practice section 827011/817011A

7011 and 7011A OPX Range Extenders

contents

1. general description

1.01 The 7011 and 7011A OPX Range Extender modules (figure 1) extend key telephone service (signaling and supervision) to stations located beyond the normal range of an electronic key telephone system or PBX. Although the 7011 and 7011A are similar to conventional dial long line (DLL) units, neither module contains a dial-pulse relay. Thus, these modules can only be used with systems that use dual-tone multifrequency (DTMF) dialing exclusively. Both modules incorporate features that allow them to be used in conjunction with the Western Electric Horizon® electronic communications system. These features include option ringing detection on a cable pair other than tip and ring and, on the 7011A, reverse-battery detection.

1.02 This Practice section is reissued to cover the Issue 2 version of the 7011 and to provide information on the Issue 1 7011A. The Issue 2 7011 differs from the Issue 1 version through the addition of switch-selectable 600- or 900-ohm terminating impedance on the switch side of the module, an option switch that allows ringing to be detected on the switch-side tip and ring leads or on a separate pair, and a ringing interrupter for use during continuous or manual ringing. The 7011A differs from the 7011 only in that the 7011A provides detection and extension of reverse-battery signals to the station.

1.03 The maximum supervisory range of the 7011 and 7011A for off-hook and ring-trip detection is 2500 ohms of external loop resistance. However, external loop resistances greater than 2000 ohms (including resistance of the station instrument) will result in loop currents below 20mA. See paragraph 2.02 for details.

1.04 When a 7011 or 7011A is used with a Horizon communications system, an option switch allows the module to detect ringing on a cable pair separate from the switch-side tip and ring leads. Ringing is then extended to the station in the conventional manner (via the station-side tip and ring leads). When used with other key systems or PBX's, the 7011 and 7011A can be optioned to detect ringing on the switch-side tip and ring leads. A continuous ringing interrupter circuit on the 7011 and 7011A

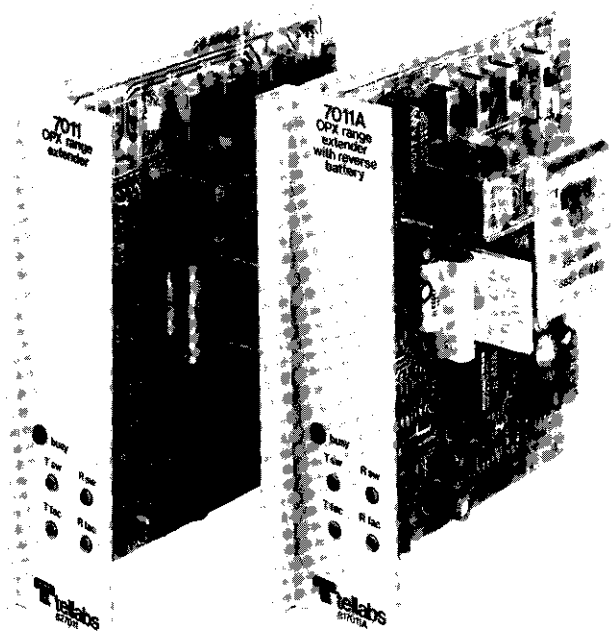

figure 1. 7011 and 7011A OPX Range Extenders

ensures that continuous or manual ringing to the station is interrupted for at least 1 second at 5-second intervals. Normal ringing cycles are not affected by the interrupter. A switch option allows the duration of ringing toward the station to be extended by approximately 1 second to ensure ringing detection in applications involving SF signaling units or tandem DLL units on the OPX facility. An electronic ring-trip circuit on the 7011 and 7011A removes ringing when the off-premises station answers an incoming call. See paragraphs 2.03 and 2.04 for details.

1.05 An integral repeat coil on the 7011 and 7011A provides isolation between the key-system or PBX line circuit and the station loop. This repeat coil may be switch-optioned for 600- or 900-ohm impedance towards both the station and the switch.

1.06 The 7011 and 7011A each derive a repeater enable lead that can be used to activate (via ground) an associated gain device during station-off-hook periods in applications where such a device is required.

1.07 Both modules operate from filtered, ground-referenced −44 to −56Vdc input power and require ringing input from a 20 to 67Hz ringing generator. The ring-trip circuit accommodates either battery-biased or ground-biased ringing generator, as described in paragraph 2.07.

1.08 Two pairs of front-panel test points provide bridging access to both the switch side and the

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station-loop side of the modules. In addition, a front-panel *busy* LED lights when the off-premises station is off-hook.

1.09 Type 10 modules, the 7011 and 7011A each mount 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.

2. application

2.01 The 7011 and 7011A OPX Range Extender modules are designed to extend key telephone service from an electronic key telephone system or PBX to a station beyond the normal range of the key-system or PBX line circuit. These modules are similar to conventional dial long line (DLL) units, but they do not contain dial-pulse relays and are therefore used only with systems that use dual-tone multifrequency (DTMF) address signaling. Both modules can provide minimum loop current of 20mA to station loops up to 2000 ohms in length. In applications where the range of the 7011 or 7011A is extended by a tandem DLL and loop currents greater than 20mA are not critical, the loop length between the OPX range extender and the DLL can be increased to 2500 ohms.

Note: *Some DTMF transmitters require up to 30mA of loop current to ensure reliable transmission of DTMF tones. To ensure a minimum loop current of 30mA, the loop resistance between the OPX range extender module and the OPX station should not exceed 1500 ohms.*

2.02 The ringing detector on the 7011 and 7011A can detect either unbiased or dc-biased ringing at voltages greater than 50Vac and at frequencies between 20 and 67Hz. An option switch allows the input of the ringing detector to be connected across the line-circuit tip and ring leads or across the module's *ac ring input* leads (pin 55 and pin 7 or 27). This allows the 7011 and 7011A to detect conventional ringing on the tip and ring leads or to detect ringing on a separate pair of leads in applications with the Horizon electronic communications system. When the ringing detector detects ringing, it operates the ring-up (RU) relay, which applies ringing to the station on the station-side tip and ring leads. Ringing to the station can also be initiated by applying −18Vdc (minimum) to the module's *dc ringing input* lead (pin 25).

2.03 The 7011 and 7011A can be switch-optioned to apply ringing to the station loop for the same time interval as ringing is applied to the switch side of the module, or to extend the ringing interval toward the station for approximately 1 second. The reason for this choice of ringing intervals is as follows: In applications using distinctive ringing, the ringing interval to the station may be as short as 1 second. This may not be long enough for reliable ringing detection by an associated SF signaling unit or a tandem DLL unit on moderately long loops. The 7011 and 7011A's ringing-extension option ensures that the ringing interval will be of sufficient length for reliable detection.

2.04 In applications where manual or continuous ringing is applied to the 7011 or 7011A from the key system or PBX, a ringing interrupter ensures that interrupted ringing is applied to the station loop. When the ringing interval applied to the 7011 or 7011A exceeds 4.5 seconds, the ringing interrupter releases the *RU* relay for 1.4 seconds. After the first interruption, the 7011 and 7011A maintain a ringing cycle of approximately 3.8 seconds on and 1.4 seconds off. Normal ringing cycles (2 seconds on and 4 seconds off) are not affected by the ringing interrupter.

ring generator bias and ring trip

2.05 The ringing generator associated with the 7011 or 7011A may be biased (referenced) either to −48Vdc battery or to ground. For proper operation of the ring-trip circuitry, the module's *ring generator return* lead must be grounded when the ring generator is battery biased, and must be connected to −48Vdc when the ring generator is ground biased. A machine-start lead, which provides a ground output when the RU relay is energized, can be used to turn the associated ring generator on when it does not provide a continuous output.

repeat coil

2.06 The integral repeat coil on the 7011 and 7011A provides isolation between the key-system or PBX line circuit and the station loop. The repeat coil may be switch-optioned to derive either 600-or 900-ohm impedance toward both the station and the switch. In general, the 600-ohm option is used with station loops consisting of nonloaded cable, and the 900-ohm option is used with station loops consisting of loaded cable. The switch-side impedance should be set for 900 ohms in applications involving the Horizon System.

repeater enable lead

2.07 The 7011 and 7011A derive a *repeater enable* lead that provides ground output whenever the off-premises station is off-hook. Thus, the *repeater enable* lead can be used to activate (via ground) an associated gain device during station off-hook periods in applications where such a device is required. (In most cases, the associated gain device is located on the station-loop side of the 7011 or 7011A.)

2.08 In addition to providing the same features and functions as the 7011, the 7011A can detect and repeat reverse-battery signals to the station. In the Horizon communications system, reverse-battery signals are used for toll-restriction applications. After the Horizon has processed an outgoing call from a toll-restricted station, talk battery supplied to that station is reversed, disabling the station's DTMF pad and preventing the station from making an unauthorized call.

3. installation

inspection

3.01 The 7011 and 7011A OPX Range Extender modules 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 7011 and 7011A each mount in one position of a Tellabs Type 10 Mounting Shelf. The modules plug physically and electrically into 56-pin connectors at the rear of the 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 Table 1 lists external connections to the 7011 and 7011A modules. All connections are made via wire wrapping at the 56-pin connector at the rear of each module's mounting-shelf position. Pin numbers are found on the body of the connector.

connect:	to pin:
SWITCH TIP	51
SWITCH RING	33
FACILITY TIP	41
FACILITY RING	49
–48Vdc (–44 to –56Vdc filtered input)	35
GND (ground in)	17
AC RING INPUT (ac ringing input from KTU)	27 and 55 or 7 and 55
DC RING INPUT (–48Vdc ringing input)	25, 21
RING GEN (ringing generator)	45, 46
RING GEN RET (ring generator return; see note)	11, 12
MACH START (ring generator machine start)	37
REPEATER ENABLE	29

Note: *If the associated ring generator is biased to –48Vdc, the* ring generator return *lead must be grounded. If the associated ring generator is grounded, the* ring generator return *lead must be connected to –48Vdc.*

table 1. External connections to 7011

option selection

3.05 Four switch options must be set before the 7011 and 7011A can be placed into service. Two of these switches, *S1* and *S3*, select the port impedance toward the key-system or PBX line circuit. The other two switches, *S2* and *S4*, select ringing options for the station. The locations of these switches on the module's printed circuit boards are shown in figure 2. Table 2 provides a brief explanation of the function and setting of each switch. Table 2 also contains a checklist that can be filled out (by checking the appropriate box for each switch) either as the module is being optioned to provide a record for future reference, or prior to installation to allow for prescription optioning of the module. Detailed instructions for setting the modules' option switches are provided in paragraphs 3.06 and 3.07.

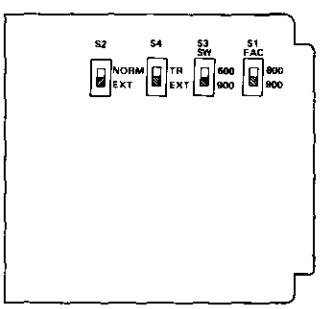


figure 2. 7011 and 7011A option switch locations

impedance options

3.06 Switch *S1* selects either 600- or 900-ohm impedance toward the station loop. Normally, the *600* position is selected when the station loop consists of nonloaded cable, and the *900* position is selected when it consists of loaded cable. Switch *S3* selects either 600- or 900-ohm impedance toward the key-system or PBX line circuit. The setting of this switch is determined by the line circuit's output impedance.

function	switch	selections	settings	check-list
station-loop-side impedance	S1	600 ohms	600	
		900 ohms	900	
normal or extended ringing to station	S2	normal ringing repeated to station	NORM	
		extends ringing to station by approx. 1 second	EXT	
switch-side impedance	S3	600 ohms	600	
		900 ohms	900	
ringing detected on switch-side tip and ring leads or on separate pair	S4	ringing detected on ac ring input leads (pins 27 and 55 or 7 and 55)	EXT	
		ringing detected on T and R leads	TR	

table 2. 7011 and 7011A switch-option summary and checklist

ringing options

3.07 Switch *S2* selects either a normal or extended ringing interval to be repeated to the station. With *S2* set to the *NORM* position, the ringing interval applied from the key system or PBX is repeated exactly to the station. With *S2* set to the *EXT* position, the ringing interval repeated to the station is extended for approximately 1 second as described in paragraph 2.04. Switch *S4* conditions the 7011 and 7011A to detect ringing from the key system or PBX either on tip and ring or on a separate pair of leads. With *S4* set to the *T/R* position, the 7011 and 7011A detects ringing on the tip and ring leads; with *S4* set to the *EXT* position, ringing is detected on the *ac ring input* leads (pins 27 and 55 or 7 and 55). The *EXT* position is usually selected when the 7011 or 7011A interfaces a Horizon system.

4. circuit description

4.01 This circuit description is intended to familiarize you with the 7011 and 7011A OPX Range Extender modules for engineering and application purposes only. Attempts to troubleshoot the 7011 or 7011A internally are not recommended. Troubleshooting procedures should be limited to those prescribed in section 7 of this Practice. Please refer to the block diagram, section 5 of this Practice, as an aid in following the circuit description.

4.02 The *ringing detector* on the 7011 and 7011A can be switch-optioned to detect ringing from the key system or PBX either on the tip and ring leads or on the ac ring input leads (pins 27 and 55 or 7 and 55). When ringing is present at the input to the *ringing detector*, the *RU* relay is operated. This applies ringing to the station loop from the ring generator lead (pins 45 and 46). With *S2* set to the *EXT* position, the *release delay* circuit extends the period during which the *RU* relay is operated by approximately 1 second. The *release delay* circuit is bypassed when *S2* is set to the *NORM* position. When the incoming ringing interval exceeds 4.5 seconds, the *ringing interrupter* releases the *RU* relay for 1.4 seconds, thus ensuring that interrupted ringing is applied to the station loop when continuous or manual ringing is used.

4.03 The 7011 and 7011A incorporate an opto-coupled *ring-trip detector* to force release of the *RU* relay when the associated station is off-hook. The *ring-trip detector* uses the dc component of the superimposed ringing signal to remove ringing toward the station.

4.04 Isolation between the key-system or PBX line circuit and the station loop is provided by an integral repeat coil with a 250-ohm midpoint resistor on the switch side. On the station side, a 400-ohm loop-current feed circuit (200 ohms on each side) provides current toward the station. A balanced *loop-current detector* senses presence of loop current and operates the *B* relay through the *B-relay timer/driver* circuit. Contacts of the *B* relay allow current to flow on the switch side of the 7011 and 7011A. A front-panel LED lights to provide a visible indication of circuit-busy status, i.e., station-off-hook.

4.05 The *current detector* and the reverse-battery (*RB*) relay on the 7011A detect and repeat reversed battery to the station. When battery (–48Vdc) is present on the ring lead (normal battery), the *RB* relay is released and battery is applied to the station-loop ring lead via loop-current feed circuitry and the *RB* relay contacts. When the line circuit reverses battery to the 7011A (–48Vdc on tip), the *current detector* operates the *RB* relay, thus placing battery on the station-loop tip lead.

4.06 In addition to the *busy* LED, the front panels of the 7011 and 7011A also contain test points for bridging access to the tip and ring leads on both the line-circuit and station-loop sides of the module.

6. specifications

transmission parameters

insertion loss
0.5 ±0.2dB at 1000Hz

frequency response
+0.3, –1.2dB re 1000Hz level, 400 to 4000Hz

port impedances
600 or 900 ohms, balanced, switch-selectable

return loss
23dB ERL minimum, both ports

longitudinal balance
55dB minimum, 300 to 4000Hz

delay distortion
less than 100μs for any pair of frequencies between 600 and 3000Hz

maximum input signal level
+10dBm at both ports

signaling and supervisory parameters

station supervisory limits
off-hook and ring-trip detection: 2500 ohms
20mA minimum loop current: 2000 ohms

loop resistance, line-circuit-side loop
250 ohms

loop seizure and release delay
20 ±3ms

facility leakage resistance
30 kilohms minimum, tip to ring, tip to ground, or ring to ground

ringing sensitivity
50Vac rms, 20 to 67Hz

ring-up delay
100 ±50ms

ring release delay
switch S2 set to NORM: 100 ±50ms
switch S2 set to EXTEND: 1.1 ±0.2 seconds

ring trip
will not falsely trip ringing with up to five high-impedance ringers and 2μF capacitance bridged across loop

continuous ringing before interrupt
4.5 ±0.55 seconds

interrupt period
1.4 ±0.25 seconds

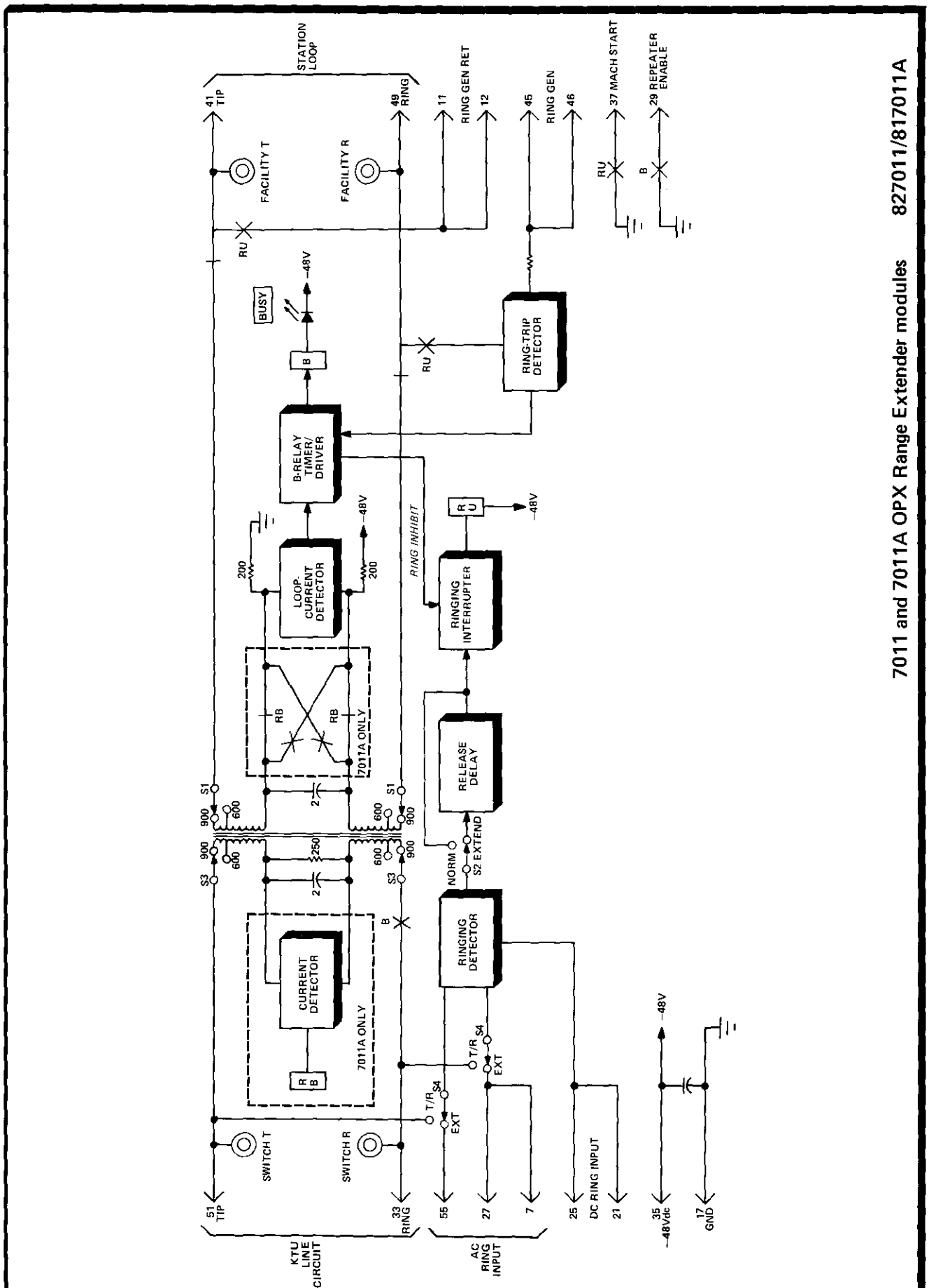
ringing cycle after first interrupt
on 3.8 ±0.45 seconds
off 1.4 ±0.25 seconds

reverse battery detection sensitivity
requires minimum 15mA loop current

physical

power requirements
voltage: –44 to –56Vdc, filtered, ground referenced
current (at –52Vdc): idle, 15mA typical, 25mA maximum;
ringing, 30mA typical, 40mA maximum;
busy, 30mA typical, 40mA maximum, plus loop current;
busy with reversed battery (7011A only), 45mA typical, 60mA maximum, plus loop current

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


7011 and 7011A OPX Range Extender modules 827011/817011A
5. block diagram
STATION LOOP
41 TIP
49 RING
11 RING GEN RET
12
45 RING GEN
46
37 MACH START
29 REPEATER ENABLE
FACILITY T
FACILITY R
RU
B
BUSY
-48V
B-RELAY TIMER/ DRIVER
RING-TRIP DETECTOR
LOOP-CURRENT DETECTOR
200
RING INHIBIT
RINGING INTERRUPTER
RELEASE DELAY
RB
7011A ONLY
S1
S3
900
600
250
2
NORM
S2 EXTEND
CURRENT DETECTOR
RINGING DETECTOR
R B
T/R
S4
EXT
SWITCH T
SWITCH R
51 TIP
33 RING
55
27
7
25
DC RING INPUT
21
35 -48Vdc
17 GND
KTU LINE CIRCUIT
AC RING INPUT

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

weight
18 ounces (510 grams)

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

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 7011 and 7011A OPX Range Extender modules. 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 7011 or 7011A modules. Unauthorized testing or repairs may void the module's warranty.

Note: *Warranty service does not include removal of permanent customer markings on the front panels of Tellabs modules, although an attempt will be made to do so. If a module must be marked* **defective**, *we recommend that it be done on a piece of tape or on a removable stick-on label.*

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, Illinois, or Mississauga, Ontario, Headquarters. Telephone numbers are as follows:

US central region: (312) 969-8800
US northeast region: (412) 787-7860
US southeast region: (305) 645-5888
US western region: (702) 827-3400
Lisle Headquarters: (312) 969-8800
Mississauga Headquarters: (416) 624-0052

7.03 If a 7011 or 7011A 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 7011 or 7011A module, notify Tellabs via letter (see addresses below), telephone (see numbers above), or twx (910-695-3530 in the USA, 610-492-4387 in Canada). Be sure to provide all relevant information, including the 8X7011X 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 7011 or 7011A in the replacement module's carton, sign the packing slip included with the replacement, 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 7011 or 7011A 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 39
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: *Equipment required for the following tests includes a VOM (Simpson Type 260 or equivalent) and a test telephone set.*

test	test procedure	normal results	if normal conditions are not met, verify:
circuit idle	Connect VOM (set to 50Vdc or 250Vdc scale) to *switch T* and *R* test points, then to *facility T* and *R* test points.	Front-panel *busy* LED off ☐. Key-system or PBX battery on *switch T* and *R* ☐. Minimum −44Vdc local talk battery on *facility T* and *R* with *facility T* positive ☐.	Local power ☐. Wiring ☐. Cable leakage not excessive ☐, or no ground on ring conductor ☐. No open KTU cable pairs ☐. No defective KTU equipment ☐.
ringing*	Connect VOM (set to 250Vac scale) to *facility T* and *R* test points. Apply input ringing (50Vac minimum) across ac ring input leads (pins 27 and 55). Observe ringing output (VOM indication).	Front-panel *busy* LED off ☐. With *S2* set to *NORM*, station-side ringing signal follows switching-side signal, 65Vac minimum ☐. With *S2* set to *EXTEND*, station-side ringing signal 1 second longer than switching-side signal ☐.	Switch *S2* correctly set ☐. No potential on pin 25 (dc ring input lead) ☐. Station not off-hook ☐.
ring trip	Observe ring trip on station side of module as follows: Connect test tel set to station-side tip and ring leads (pins 41 and 49). Connect VOM to *facility T* and *R* test points. Initiate ringing and go off-hook with test tel set. Observe ring trip, first with VOM set to 250Vac scale, then to 50Vdc scale.	When test tel set goes off-hook, *busy* LED lights ☐, and ring voltage is removed from station side ☐. (Ring voltage may or may not be removed from KTU side [pins 27 and 55]; this is function of KTU.) After ring trip occurs, dc loop voltage drops (on both station and KTU sides) ☐.	Station is within specified range of 7011 or 7011A ☐. DC-biased generator is present ☐.
supervision	Connect VOM (set to 50Vdc scale) to *facility T* and *R* test points.	When VOM is connected as indicated, *busy* LED lights ☐, and voltage across tip and ring drops by a minimum of 6 volts ☐.	Local power ☐. Option switches correctly set ☐.
reverse battery (7011A only)	Repeat "supervision" test procedure. Cause key system or PBX to send reverse battery signal.	Observe oppositve polarity on VOM when reverse battery signal transmitted ☐. Busy lamp remains on ☐.	Local power ☐. Battery reversed at switch T and switch R test points ☐. Wiring to station (if DTMF pad not working) ☐.
talking	Connect test tel set to *facility T* and *R* test points and dial local CO milliwatt test line.	1000Hz tone audible from call to local milliwatt test line ☐.	Station is within specified range of 7011 or 7011A ☐.
call release	With test tel set connected as above, go from off-hook to on-hook condition.	Front-panel *busy* LED goes off when tel set placed on-hook ☐.	Longitudinal voltages are less than 10Vac ☐. Cable leakage not excessive ☐.

*If the loop between the 7011 or 7011A and the station has excessive leakage resistance, or if capacitance in excess of 5μF exists between tip and ring or from ring to ground, pre-trip may occur. This will be evidenced by a short burst of ringing during each ringing cycle. If this symtom occurs, the abnormal loop condition should be corrected.

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