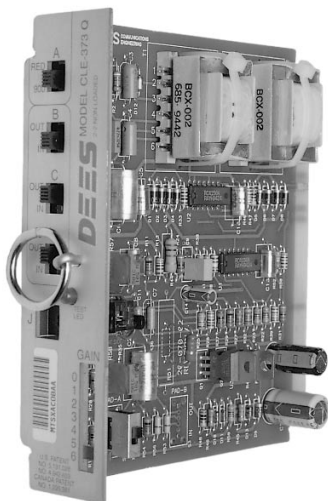


MODEL CLE-373

Centrex Loop Extender

1. GENERAL

1.01 The CLE-373 modules are used with Northern Telecom's DMS-100™ and MBS/EBS phones over non loaded cable pairs when the 900 ohm measures 8 KHz cable loss is between 21-35 dB. These modules strengthen both voice and messaging signals as well as augmenting the DC power. They extend the MBS/EBS range of operation to 21 kf of 26 gauge or 26 kf of 24 gauge cable. In cases where 22 gauge cable is used the operation range is extended by up to 30 kf. Typical use requires installation at the Central Office, -48 VDC battery, an IN-OUT pair jumpered between the CLE-373, Central Office and the Subscribers Cable Pair. The CLE-373 is not used for any other purpose and is easily installed.



- 1.02 **Linear-Full Duplex Gain** – The CLE-373 insures messaging integrity between the Central Office and the MBS/EBS by means of an adjustable 4-8 KHz gain rather than by the regeneration of half-duplex data commands. Voice gain is also provided but is not user adjustable.
- 1.03 **Battery Feed** – The CLE-373s' provide their own fused, current limited, transformer isolated, lower resistance battery feed circuits.
- 1.04 **Service Alignments** are made by operation of the A, B, C, and D switches (see section 4.06) Switch A is set to the calibrate position and switches B, C, and D are operated. The LED will go out when B, C, and D are in correct position.
- 1.05 **Front Panel Bantam Jack** – This jack opens the CLE-373 from the Central Office and is a convenient place to send or receive a tone through both the module and the cable pair.
- 1.06 **One Way Pad - Station to Central Office** – One switch selectable pad labeled PAD A (s dB) has been added to the module. This is used to alleviate possible speakerphone problems. See paragraph 6.06.

2. CIRCUIT DESCRIPTION

2.01 **General** – The CLE-373 is a two port device that is installed at the Central Office between the switching equipment and the subscribers cable pair. Its DC function on the CO side is to let current flow when the station is connected and to block it

when its not. Its DC function on the station side is to safely source a lower resistance Battery Feed than offered by the Central Office line card to the loop (cable plus the station set). The purpose of the Amplifier portion of the CLE-373 is to strengthen voice and messaging signals in both directions simultaneously as well as to convert the cable impedance to an optimal value in order to benefit transmission.

2.02 **Functions** – The Central Office tip and ring are connected through edge connector positions TA and RA to the front panel jack. When a plug is inserted into this jack, the CO is disconnected from the module and the plug is connected in its place. The CO tip and ring passes through switch “A” to the isolating transformer. When switch “A” is operated, the CO is disconnected from the module and a 900 ohm termination is connected in its place.

A loop switch on the CO side of the transformer allows DC current to pass when the current detector senses the presence of an Electronic Business Set on the line. The DC current is used to signal the CO that a set is connected.

A second isolating transformer connects the module to the subscribers tip and ring through edge connector positions TB and RB. Battery feed is supplied through this transformer to power the set. A current limiter is required due to the low resistance of the battery feed.

Between the two isolating transformers is a full duplex amplifier which can pass over 8KHz, including voice frequencies. Switches B, C and D control the impedance of the network which matches the module to the line. The 8KHz signalling amplitude may be controlled separately from the voice frequencies through the GAIN switch. The VF gain path is fixed.

2.03 **Fusing** - On the station side of the CLE-373 there is a permanent 250 milliamp fuse and bi-polar current limiting through the balanced transformer windings. Fuse operation should not occur with inadvertent connections.

2.04 **Adjustments, Test LED** – The A, B, C, D switches and associated circuitry are used to provide optimal full duplex amplification without generating unwanted signal oscillation. Oscillation is detected by means of a signal transistor which turns on the Test LED. When switch “A” is in the calibrate

position, circuitry is enabled which permits optimal adjustment as per paragraph 4.06.

2.05 **Technology** – The technology used is called **Compensated Reciprocal Negative Impedance 2W Amplifier**. Stability and excellent messaging are characteristics of this technology. Both USA and Canadian patents have been issued on this technology.

3. APPLICATION

3.01 **Metallics Copper Pair Availability**

Select a non loaded cable pair having 22, 24 or 26 gauge for the first 6000 ft. Range extension requirements are best determined (if in doubt) by taking the 8KHz loss measurement with 900 ohm equipment. Measured losses under 21 dB will work without the CLE-373. Measured losses over 21 dB but under 35 dB are candidates for the CLE-373.

3.02 **Cabling Pair Testing**

When cable pairs appear to need line treatment it is suggested that the CLE-373 be used for testing.

1. Install the cable pair to the subscribers side of the CLE-373 (TB,RB)
2. Set switch “A” to “CAL” (RED) position
3. Set “GAIN” to maximum

If the Test LED is off or can be turned off by adjusting switches B, C or D as per section 4.06 than the cable pair is acceptable to be used with the CLE-373.

3.03 **Shelving**

The CLE-373 can be mounted in the following standard type shelving. For ordering information see Section 9.

Wescom 400
Tellabs Type 10
Wescom Universal Shelf
RBOC, MFT Shelving
(Requires a Westell 9407-00 NCTE/MFT Adapter)
Northern Telecom UVF

4. INSTALLATION

4.01 **Wire Shelves** – as per the following charts. Make sure the correct CLE-373 is installed for the wire gauge. (See ordering information - Section 9).

4.02 **Miscellaneous Wescom 400 or Tellabs Type 10 Shelves**

CLE-373Q, P modules

Lead	Designation	Pins
TB □	Sub	50
RB □		49
TA □	C.O.	40
RA □		39
-48 VDC		35
Ground		17

4.03 **Prewired Wescom 400 or Tellabs Type 10 Shelves**

CLE-373Q, P modules

Lead	Designation	Pins
TB □	Sub	41
RB □		49
TA □	C.O.	51
RA □		33
-48 VDC		35
Ground		17

CLE-373R, N modules

Lead	Designation	Pins
TB □	Sub	41
RB □		47
TA □	C.O.	55
RA □		49
-48 VDC		35
Ground		17

4.04 **Westell 9407-00 NCTE/MFT Shelves**

CLE-373R, N modules

Lead	Designation	Pins
TB □	Sub	14
RB □		13
TA □	C.O.	17
RA □		19
-48 VDC		11
Ground		18

4.05 **Northern Telecom UVF Shelves**

CLE-373B, B2 modules

Lead	Designation	Pins
TB □	Sub	1
RB □		4
TA □	C.O.	2
RA □		3
-48 VDC		8
Ground		7

4.06 **Adjusting CLE-373 For Service**

Once the cable pair has been properly jumpered, the CLE-373 can be adjusted for service. The MBS/EBS may be installed or not. Just operate the A, B, C and D two-way and 8KHz slide switches on the unit as per the following instructions.

Caution:

The procedure will take the customer out of service while it is being performed.

- A. Set the "A" switch to the RED (CAL) position
- B. Set the 8KHz gain switch to Maximum CLE-373Q, R, P, and N - Position 6
- C. Set PAD A to OUT.
- D. Start at step 1 and proceed sequentially until the LED is out. IF LED IS OUT IN STEP 1 USING CLE-373Q OR R ON 26 NL CABLE IT IS CALIBRATED PROPERLY.
- E. Return switch A to 900

Switch Positions

	B	C	D
1	OUT	OUT	OUT
2	IN	OUT	OUT
3	OUT	IN	OUT
4	IN	IN	OUT
5	OUT	OUT	IN
6	IN	OUT	IN
7	OUT	IN	IN
8	IN	IN	IN

Once the CLE-373 is adjusted (per 4.06), the slide switch, which only affects data messaging, can be turned down 1 or 2 steps on the Q, R, P and N modules. This will improve operating margins.

- i.e.
1. adjust CLE-373 as per paragraph 4.06
 2. adjust slide switch down until unit starts to fail
 3. move slide switch up TWO notches

Notes:

1. When adjusting a CLE-373P, N, or B2, a LED ON condition must occur at Switch Position 1 during calibration.
If LED is OFF, check the cable gauge, it is probably 26 gauge and a CLE-373Q, R, or B should be used.
2. When adjusting a CLE-373Q, R, or B and it takes both switches C and D to be in the "IN" position to turn the LED off, the cable is a candidate for the CLE-373P, N or B2.

3. Switch A must be returned to 900 for service. If this return to 900 causes the LED to re-light it may mean the MBS/EBS is not installed correctly and the jumpers have not yet been connected to the switch.
4. If the LED stays on regardless of switch settings it indicates a problem. In this case go to the Trouble Shooting sections (Section 6).

5. TESTING

5.01 General

Do not test with the cable open or removed. A 0dBm level tone can turn on the LED while it is applied. A 10dBm level tone will not turn on the LED. Otherwise (except for cable pair testing per paragraph 3.02) if the LED is on, go to Trouble Shooting).

5.02 Module gain

To measure the gain of the CLE-373, a tone is inserted into the Bantam jack on the front panel and readings are taken with a TMS (Transmission Measuring Set) across TB and RB (Subscribers Tip and Ring).

5.03 Testing for set installation from the CLE-373

If inserting a Bantam Plug (disconnected) into the panel jack turns the LED from OFF to ON it means the MBS/EBS is not installed or there is a Tip and Ring reversal.

5.04 Diagnostic testing from the console

Perform line diagnostic tests from the maintenance console at the switch. If passed, messaging between the switch and the set is working.

5.05 Net loss testing

End to end level differences from a 900 ohm TMS that replaces the MBS/EBS to another 900 ohm TMS jack inserted into the CLE-373 front panel provides net loss on an end to end basis. End to end level difference measurements will confirm cable losses with and without the CLE-373. A maximum (8KHz) 24dB loss from the station to the switch and a 26.6dB loss from the switch to the station can theoretically be tolerated. If the 8KHz gain performance of the CLE-373 is not sufficient to provide adequate levels within the 21-35 dB cable loss zone, please call our customer service department.

5.06 Re-setting the 8KHz gain

The initial setting is always at maximum but can be lowered on Net Loss testing. If no test equipment is available, lower the gain until there is a set failure, then increase by two notches.

5.07 Return loss

Return loss readings at the 900+2.16 mfd setting are

easily taken from the front panel jack once the MBS/EBS is installed.

6. TROUBLE SHOOTING

6.01 LED stays on - wiring causes

The CLE-373 self generating tone occurs when the LED is on. A monitor can help find this tone and the correct connections can be verified. TA and RA should be jumpered to the Central Office side and TB and RB will go to the station side. If wiring errors are found, correct them and re-adjust the CLE-373 as per Section 4.06.

6.02 LED stays on - outside plant causes

If wiring is correct and adjustments have been executed as per instructions and LED is still ON, then outside plant is suspect. Look for a load coil (high 8KHz loss) or too much 22 gauge cable near the Central Office. Also look for a two cable gauge difference in the first 6000 feet of cable leaving the CO. Load coils must be removed and the 22 gauge would require the CLE-373P, N, or B2 module. Normal amounts of Bridge Taps are not a problem.

6.03 No service - LED off

If the LED is off and can be made to turn on by

- A. Inserting a 1 KHz tone (0 Dbm) into Bantam jack
- B. Removing TB or RB from station side
- C. Misadjusting switches B, C, or D then the CLE-373 is working fine.

The CLE-373 should also exhibit gain (Section 5.02) from a Central Office activated test tone. A good unit must have approximately -48 VDC measured across the station side, also a Tip-Ring reversal on the Central Office side will show up as a short (or low voltage).

6.04 CLE-373 aligns properly but voice level low

Check Central Office TIP and RING for reversals

6.05 CLE-373 aligns properly but voice fades in and out

- A. Align the CLE-373 as per the instructions on page 3.
- B. Set the gain switch at position 6 or max.
- C. Lower the gain switch on the CLE-373 one notch at a time until dial tone starts to fade.
- D. Raise the slide switch two notches.

6.06 Speakerphone noise on short loops

If there is squealing or feedback on speakerphones operating on short loops, Set PAD A to IN.

If the problem persists, it may be the phone, cable pairs or location of set.

7. SPECIFICATIONS

7.01 2W input impedance

The CLE-373 converts the non loaded cable impedance to 900+2.16 mfd when optioned and applied per this practice.

7.02 Return loss

The CLE-373 improves the cable loss by 14dB (typically).

7.03 DC loop range

Loop resistance is extended to 1750 ohms (on 26 gauge non-loaded cable with Central Office battery between -48 and -56 VDC).

7.04 AC loop range

Message integrity is extended to cable pairs whose measured 8KHz (900 ohm) losses range between 21 and 35 dB.

7.05 Gain

Typical gain at 8KHz is 0-9 dB (selectable).

7.06 DC current protection to set

Individual unit fusing is 250 milliamp, current limiting is 35 milliamps, clamping is at -48 VDC with loop sourcing through longitudinally balanced transformer windings.

7.07 DC current, auxiliary fusing

When using -48 VDC, typically 40 mA plus loop current, a 1.5 Amp fuse per 12 CLE-373 is recommended.

7.08 Miscellaneous

Distortion.....50 dB down
 Longitudinal balance60 dB nominal
 Idle noise.....less than 16 dBmC
 Cross talk.....80 dB side by side

7.09 Environment

Clean and dry with a temperature range of 32° - 120° F.

7.10 Typical results and notes

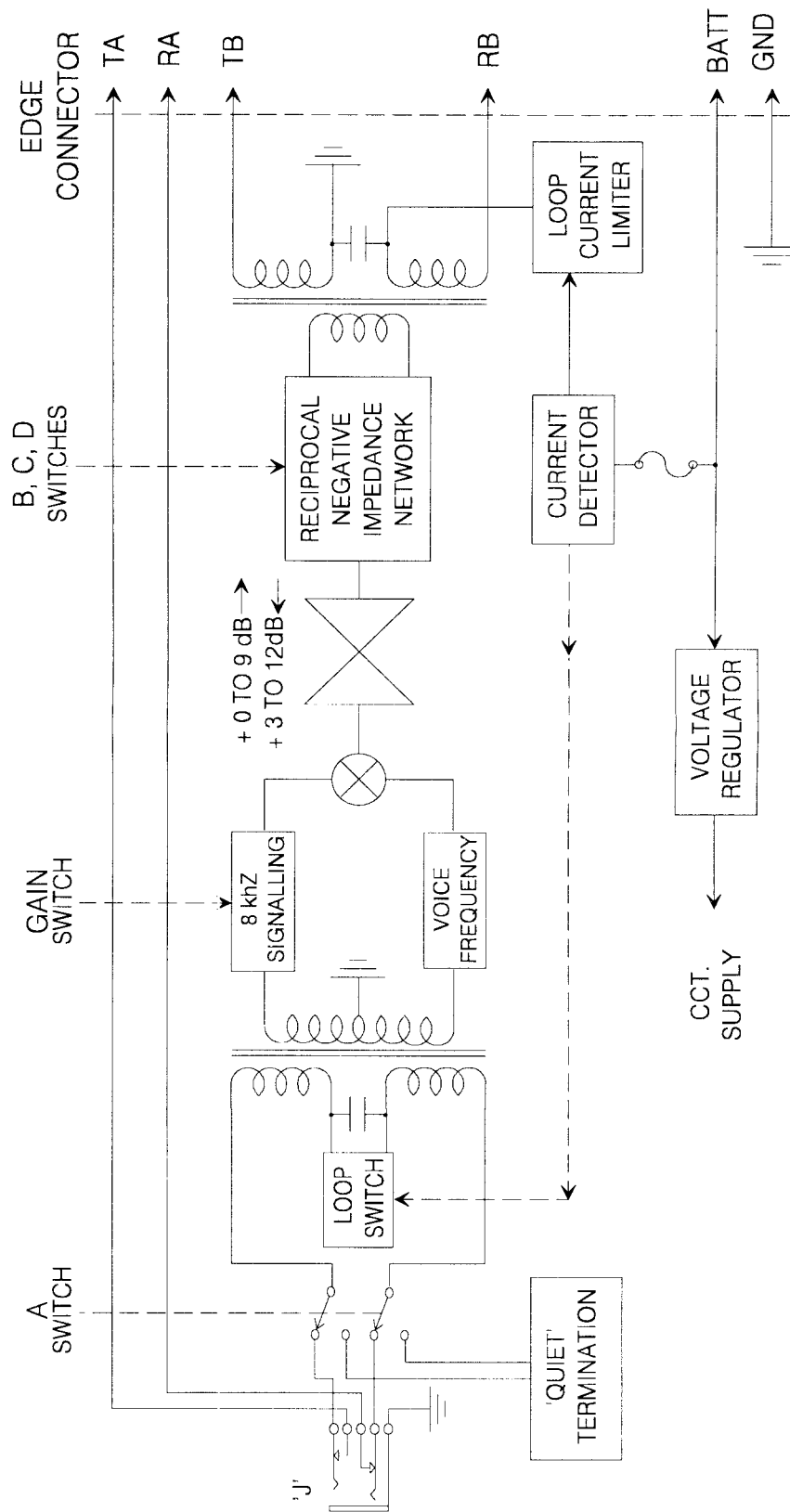
- A. Gain is somewhat compensatory for loop length.
- B. Central Office to station VF gain is partially equipment compensatory.
- C. Station to Central Office (8KHz) gain is equipment compensatory (3 dB higher).

7.11 Typical line losses

- The following examples use a 26 gauge non-loaded Weco artificial cable and a Wilcom 195 level tracer.
- A. RL is 500 - 2500 average.
 - B. The 8KHz gain is set to maximum.
 - C. Switches B, C, and D are OUT.

Cable Length 13.5 kilo-feet.	Frequencies (Hz)	300	500	1000	2000	3000	8000	Return Loss
	Cable (dB)	4.0	4.8	6.0	9.2	12.0	21.2	8.0
With Dees CLE-373	Sta. to Switch (dB)	3.9	3.8	3.1	3.0	4.2	9.0	NA
	Switch to Sta. (dB)	2.9	2.9	2.1	2.5	4.5	12.0	14.0
Cable Length 15.0 kilo-feet.	Frequencies (Hz)	300	500	1000	2000	3000	8000	Return Loss
	Cable (dB)	4.3	5.1	6.6	10.3	13.6	23.5	8.0
With Dees CLE-373	Frequencies (Hz)	4.3	4.1	3.5	4.5	6.0	11.0	NA
	Cable (dB)	3.1	3.1	2.8	4.0	6.0	14.2	15.0
Cable Length 18.0 kilo-feet.	Frequencies (Hz)	300	500	1000	2000	3000	8000	Return Loss
	Cable (dB)	5.2	6.0	8.1	12.9	16.5	27.8	8.0
With Dees CLE-373	Frequencies (Hz)	5.0	5.0	5.0	7.1	8.9	16.2	NA
	Cable (dB)	3.9	3.9	3.9	6.6	9.0	19.2	17.0
Cable Length 21.0 kilo-feet.	Frequencies (Hz)	300	500	1000	2000	3000	8000	Return Loss
	Cable (dB)	6.0	7.0	9.8	15.1	19.1	32.4	7.0
With Dees CLE-373	Frequencies (Hz)	5.5	5.8	6.5	9.7	11.5	20.0	NA
	Cable (dB)	4.5	4.6	5.5	9.0	11.7	23.2	17.0

8. BLOCK DIAGRAM



9. EQUIPMENT ORDERING, SERVICE

9.01 The number of modules required is one per 2W non-loaded cable pair MBS/EBS station combination. Specify the number of modules required and select the model desired from below.

9.02 Order Information

Cabling to card connector pins

SHELF TYPE		TA	RA	TB	RB	BATT	GRND	CABLE GAUGE	ORDER
WESCOM 400 or TELLABS TYPE 10	MISC.	40	39	50	49	35	17	24/26	CLE-373Q
								22/24	CLE-373P
	PREWIRED	51	33	41	49	35	17	24/26	CLE-373Q
								22/24	CLE-373P
								24/26	CLE-373R
								22/24	CLE-373N
WESCOM UNIVERSAL SHELF		AS REQUIRED				35	17	24/26	CLE-373Q or R
								22/24	CLE-373N or P
MFT		17	19	14	13	11	18	24/26	CLE-373R WITH CLE-ADAPTER
								22/24	CLE-373N WITH CLE-ADAPTER
NORTHERN TELECOM UVF		2	3	1	4	8	7	24/26	CLE-373B
								22/24	CLE-373B2

9.03 Service

For technical assistance and ordering information, contact:

Dees Communications Corporation

4130 - 148th Avenue NE

Redmond, Washington, USA, 98052

Tel: 1-800-654-5604 or 425-869-1963

Fax: 425-869-0717

www.dees.com

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