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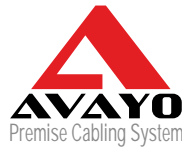
# OPERATION & MAINTENANCE MANUAL



## AVAYO ELECTRONICS CANADA CORPORATION

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### 1. OVERALL PURPOSE

The overall purpose of the Voice / Data / CATV distribution cabling system is to provide a **STRUCTURED CABLING SYSTEM** for connecting each of the Telephone and Data outlets to the respective operating systems.

The structured cabling system is designed to provide the flexibility to change the telephone outlets to data outlets and vice versa, by suitable changes in the wiring closets. The structured cabling system interconnects telecommunication equipment (for Data, Voice or CATV) in a multi – vendor environment and is based on modular sub-systems that are independent yet complimentary. This approach facilitates easy growth, since changes in one sub-system do not affect others. The system uses hierarchy of nodes laid out in a star topology, thus facilitating moves, changes and additions without having had to again lay the cables.

### 2. SYSTEM DESCRIPTION

In all the areas covered under this package, both the voice, data & Etisalat Tv outlets are Installed with RJ-45 sockets , into which the client will be able to plug in the cables (line cords) connecting to Telephone / Fax machines or Computers with suitable cross-connections at patch panel. The voice outlets are meant, not only for telephone connections, but also for fax machines, ISDN connections, modem connections and Internet connections of ETISALAT. The outlets are designated as Data, Voice & CATV(Etisalat TV) as per the requirement. All data, voice or CATV outlets are fully interchangeable.

#### **2.1: MDF and Building Wiring Description:**

MDF (Main Distribution Frame) is located at Ground Floor serve the outlets from Basement to roof Floor. These 702 nos. of outlets are wired in a star topology. The AVAYO Cat 6 cables supplied and installed foHorizontal wiring. The one end of Cat6 horizontal cable terminated onto outlets and other end onto the respective RJ45 patch Panels within the ONU located at the entrance of each apartment. The Etsialat approved 2-Core Single mode Fiber Optic Cable is laid between MDF and ONU located in each apartment as a back bone riser. These fibre cables are terminated onto the respective fiber patch panels and housed inside the 42U freestanding Cabinet on MDF side and 12U Wall mount Cabinet on ONU side by Etisalat.

#### **2.2: Cabling for Workstations (horizontal cabling system):**

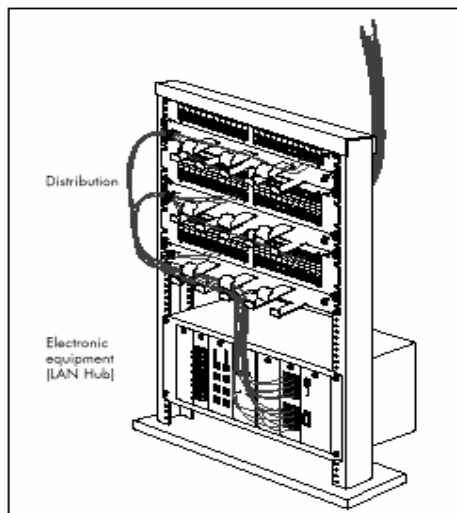
Each workstation outlet has:

- (1) Dual or Single Points terminated with RJ 45 sockets, dust protected with an Shutter arrangement. ( Recommended 7 - 10 cm length cable for any re termination )

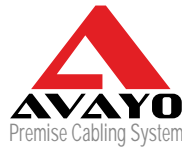
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- (2) The above RJ 45 sockets have Category 6 Connector (Modular Data, Voice outlet) Connectors. The line cords for Computers/ telephones/ internet/ modems are plugged in to these RJ45 sockets.
- (3) The Cat6, 8-positions connector is wired as per EIA/TIA 568B configuration.
- (4) The above category 6 cables, leading from **ALL data outlets** on the floor sockets are terminated on to a RJ45 connector on a patch panel.
- (5) The above category 6 cables, leading from **ALL voice outlets** on the floor sockets are terminated on a RJ45 connector on a patch panel.
- (6) The above category 6 cables, leading from **ALL CATV outlets** on the floor sockets are terminated on a RJ45 connector on a patch panel.
- (7) The cable between the work area and the Patch panel is called “Horizontal Cable”.
- (8) The Panels, where the data, voice and CATV cables are terminated is **fitted in a 19” cabinet**.
- (9) The cross-connections of the data outlets to the hubs/switches in the cabinets is done by plugging the RJ45-RJ45 patch cords in to the selected sockets on patch panel and any port of the hub/switch.

### Typical arrangement of Patch Panel Installation



**Horizontal Cabling:** As mentioned earlier, the horizontal cabling is that portion of the system which links the telecommunications closet to the work area, with a 4 pair UTP cable. The maximum length allowed for horizontal cable is 90 meters.



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**Work Area:** The work area is that building space where the occupants interact with telecommunications Terminal Equipment. The work area sub-system includes a variety of hardware (not in present scope) such as a terminal, PC, or workstation or a server or a telephone instrument. This hardware is plugged in to the telecom outlet through a modular line cord.

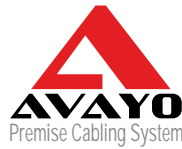
### 3. MEASURED DATA

The measured data for each horizontal cable link is that which is measured from the modular connector at the faceplate up to the patch panel. **The cables for the Data transmission are terminated on a PCB patch panel and those for Voice transmission are also terminated on a PCB patch panel.**

The measured data comprises of the following:

- i. Wire map: The correct wire map ensures that there is no cross connection or mismatch of pairs between the terminations at the two ends of the cable. The terminations at MDVO connectors are made to EIA/TIA 568B configuration.
- ii. Length of the cable: The length of the cable from faceplate to the patch panel should be within 90 meters, for compliance with EIA/TIA standards.
- iii. Propagation delay
- iv. Impedance of the cable in ohms
- v. Resistance of the cable in ohms.
- vi. Capacitance in Farads.
- vii. Attenuation in Decibels.
- viii. Return loss of signal at scanner end, in decibels.
- ix. Return loss of signal at injector end, in decibels.
- x. NEXT (Near End Cross Talk) in decibels.
- xi. ACR (Attenuation to Cross Talk Ratio)

The test results are automatically recorded in the testing equipment and are saved for future reference/print outs.



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### 4. MEASUREMENT POINTS

The above mentioned test data results are measured from each end of each cable connection between:

- i. Modular connector at the faceplate of the data/voice outlet.
- ii. Corresponding PCB patch panel port in the hub room.

### 5. TEST EQUIPMENT USED

A two-way cable analyzer is used to test each cable link. All the cables are tested with the analyzer. The test is done on 100% cable links. By using of FLUKE networks DSP-4000 scanner, USA made, is used to test the connectivity of each cable link.

The FLUKE networks Scanner is capable of performing all the tests mentioned above in section 3.

This cable analyzer automatically compares the tested results with the international standards, which are stored in the analyzer and are preset. The results are displayed as PASS or FAIL depending upon the outcome of the comparison between the standards and the actual results. In case of FAIL results, the analyzer display shows the exact cause of failure so that the fault of the cable link can be easily rectified.

The cable link fault that is known from the display of the analyzer is rectified and the test is conducted again till the display shows PASS. Thus the results of all the cable links are made within acceptable limits.

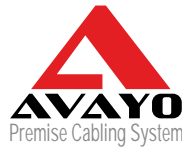
The test results are automatically recorded in the testing equipment and are saved for obtaining print outs later.

### 6. OPERATION

#### 6.1 Cross-connection :

**The Operation of the structured cabling system mainly involves in cross-connections to activate any chosen outlet socket for data service or voice service and to effect moves and changes.**

- a. The Voice outlets in the patch panel are cross-connected to the Riser Cable through RJ45 cords



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By suitable cross connection between selected position of the Riser Cable and the sockets where the horizontal cables are terminated, the client will be able to connect the active components of the Voice system. The voice cross connection is done by means of RJ45-RJ45 patch cords from riser cable patch panel to corresponding position on patch panel.

- b. The cross-connections of the data outlets to the hubs/switches in the Cabinets is done by plugging the RJ45-RJ45 patch cords in to the selected sockets on patch panel and the port of the ONU

### **6.2 Calibration and testing :**

The Voice, Data and CATV Cabling system, as installed, does not need any further testing, after the testing 100% done at the time of installation.

### **6.3 Adjustments :**

The adjustments in Structured Cabling System for Data, Voice and CATV system relate to “**Moves, Additions and Changes**”. The system administrators’ major concern is for the above three aspects, where people and / or equipment is relocated within the organization. The Structured Cabling system allows these operations to be completed generally with minimum or no interruption to existing network users.

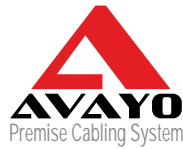
In most cases, cross connections between the equipment and distribution fields can be accomplished without compromising system integrity. However, prior to performing changes involving connections at MDF (Main Distribution Frame) or between equipment fields of telecommunications closets, please consult the installers. This will ensure that changes performed will conform to system specifications.

Moves, additions and changes involve appropriate cross –connections at the telecommunications closet and or at the MDF. In order to implement these, it is imperative to maintain accurate records of the communications facilities. It is suggested that trained personnel who are conversant with the installation should be permitted to effect any changes.

### **6.4 Moves:**

Depending upon the location of the work stations /terminals, use the following steps:

- a. Disconnect the workstation /terminal at the old outlet. Note the identification number on the faceplate at the old location and the new location where the workstation is to be moved.



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b. For Patch panel system (for Data / Voice / CATV cabling):

Find the ports having the above identification numbers on the patch panel in the telecom closet. Remove the patch cord from the old position and plug into the new position.

In the system where all the cables from both data and voice outlets are terminated in patch Panel, following method can affect the “Moves”. Simply unplug the RJ45 connector of the patch cord from old position (identified by number on the faceplate) and plug it in to the new position on the patch panel.

c. Reconnect the workstation /terminal at new outlet.

d. Update the records.

### **6.5 Addition of a service:**

The Structured Cabling System allows for substantial growth of the communications facilities, consequently, there may be a few communications outlets on each floor of the building where there are no work stations/terminals connected. Cables from these additional outlets are already terminated in the hub rooms and numbered. But these are not cross-connected to the distribution field, at the time of installation.

The following steps shall be used to add a new workstation /terminal.

a. *At the Work station:*

- For data and LAN services connect the device (with appropriate adapters) to an unused data outlet.
- For voice or voice band data services, connect the phone or modem to an unused voice outlet, with proper adapter.
- Record the outlet used.

b. *At the ONU Side:*

i. For Patch panel system (for Data / Voice / CATV cabling):

Identify the port, corresponding to above outlet (having the above identification numbers) on the patch panel in the ONU. Connect one end of the patch cord to this port and plug the other end of patch cord to the any free port of the equipment (like ONU etc.).





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For patch panel system, use patch cord of appropriate length. Route the patch cords NEATLY through distribution rings located adjacent to the mount and plug the patch cord into the desired post.

- Add the new workstation
- Update your records.

While using the patch cords always use shortest possible (leaving

necessary slack). This practice facilitates easy administration and also promotes a NEATER appearance of the cross-connect system, which is essential.

### **6.6 Removal of service**

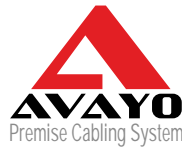
For Patch panel system:

- a. Identify workstation to be removed and disconnect.
- b. Identify required port on the patch panel at distribution field and equipment in the ONU and MDF (if necessary) by referring to the records.
- c. Un-plug the patch cord at both ends (distribution as well as equipment fields) and removes the patch cord.
- d. Update the records.

### **6.7 Change of service:**

Depending upon the location of the work stations /terminals, use the following steps:

- a. Disconnect the workstation /terminal at the old outlet. Note the identification number on the faceplate at the old location and the new location where the workstations is to be moved.
- b. For Patch panel system:  
  
Find the ports having the above identification numbers on the patch panel in the telecom closet. Remove the patch cord from the old position and plug into the new position.
- c. Reconnect the workstation /terminal at new outlet.
- d. Update the records.



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### 7. MAINTENANCE

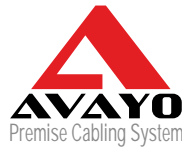
maintaining the Structured Cabling System. From the summary it can be seen that for an IDC system, all operations involving changes of service **MUST** be performed only by the installers or by trained in-house personnel. The operations at patch panel can be done by anyone without a formal training. Authorized persons should also do recording of the Changes.

#### 7.1 Routine maintenance operations

	<u>At patch panel</u>	<u>At BIX mount</u>
a. Additional service	Any one	Trained personnel or installers
b. Removal of Service	Any one	Trained personnel or installers
c. Change of location of workstation	Any one	Trained personnel or installers
d. Record Keeping Electronically/Manually	Authorized personnel	Authorized personnel

#### 7.2 Other maintenance operations

Operations	Recommended Persons
<b>a. Addition of new RJ45 Panel at ONU Side</b>	<b>Only system installers</b>
<b>b. Termination &amp; Re termination of Electronic equipment.</b>	<b>System Installers or In-house trained personnel</b>
<b>c. Moves, additions &amp; changes to horizontal system</b>	<b>System Installers or In-house trained personnel</b>
<b>d. Moves, additions &amp; changes to Riser (Backbone) system</b>	<b>System Installers or In-house trained personnel</b>
<b>e. Moves, additions &amp; changes to Data Backbone to Data Backbone</b>	<b>System Installers or In-house trained personnel</b>
<b>f. Moves addition and change to building entrance systems</b>	<b>Local Telephone</b>



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If any problems are encountered, the following things should be ensured:

- a. Ensure that the workstations and other electronic hardware items (e.g. hub, switches, digital telephones, etc.) are properly connected and configured according to manufacturer's instructions.
- b. Ensure that line cords (appropriate type) with necessary adapters are used and connected properly. These line cords are checked at the time manufacture.
- c. Ensure that cross –connection (patching) is done properly.

If any further problems are encountered, please contact the installers of the Structured Cabling System.

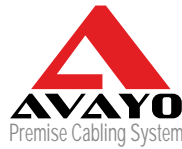
## 8. PREVENTIVE MAINTENANCE TASKS

*The basic preventive maintenance tasks are given below:*

- a. Periodic maintenance involving the general cleaning (vacuum suction cleaning and inspection of the system should be carried out by in –house personnel.
- b. Checks for damage that may be caused by improper plugging of line cords /patch cords can be done whenever any difficulty in use of the workstation equipment is reported (e.g. Telephone connection sometimes on and sometimes off etc). Check the physical condition of the patch cord or line cord especially at the connector end. Replace if found defective.
- c. Ensure that the patching is done correctly to same outlet and corresponding connector in patch panel.

Other than above, the system is maintenance free unless a fault situation occurs due to external reasons in which case the installer should be called to rectify the fault.

For effective and efficient operation and maintenance of the structured system, it is highly recommended that all the concerned personnel should be properly trained.



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### 9. MAINTENANCE SUMMARY

It is recommended to follow the below given schedule for maintenance of the Data /Voice/ /CATV structured cabling system:

- a. Quarterly
  - General cleaning by vacuum method
  - The period may be changed depending upon dust and environment conditions
- b. Yearly
  - Cross-connections after any changes are done
- c. Once in 2 years
  - System inspection by in-house trained Personnel.
  - Verifying that the records are made update.

### 10. RECORD KEEPING

A wide variety of services such as Voice, Data (and imaging /video) & CATV systems are used by means of the structured cabling system.

Effective management and proper recording of communications facilities reduces down time of network and cuts down material and labor costs. Hence every move, addition and change at IDFs, MDF and the telecom closet must be recorded either manually or electronically, for operational, administrative and maintenance reasons.

Generally, the maintenance of the cabling system involves the following elements to be recorded.

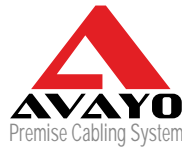
#### **10.1 Termination Hardware:**

- Communication outlets
- Patch Panels

#### **10.2 Location of MDF**

#### **10.3 Equipment, which may be connected:**

- Computer
- Hubs / Switches
- PABX
- Telephones
- Multipliers
- Modems/ ISDN adapters
- Fax Machines



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And also connecting elements such as patch cords, line cords etc.

- Areas where telecommunications equipment is located.

**10.4 Personal Records-** Name, telephone number (or telephone extension number, room number, equipment identification, services.

These elements of the network can be managed either manually or through use of CABLE MANAGEMENT SOFTWARE.

### **The manual records should have:**

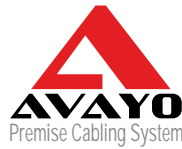
- Details of Terminals, recording where the cables are terminated in the building
- Cable record sheet showing type of cable used for backbone or horizontal also showing where the cable is coming from and at which location it is terminated.
- The equipment records showing where the equipment is located, type of equipment, number of ports, and location of equipment termination.

### **10.5 Exchange of components and assemblies:**

The RJ 45 Modular Data/Voice/CATV outlet connectors and the face plates can be exchanged between different outlets provided they are of same type and color and model number.

## 11. SPECIAL TOOLS, TEST EQUIPMENT

**No special tools are needed** for effecting changes, moves, additions of the workstations in this project, since patch cords with RJ45 plug-able connectors are supplied in this project. These patch cords can be easily inserted in the RJ45 ports of the patch panel as well as the active equipment.



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### 12. NAMES & ADDRESSES OF THE MANUFACTURERS

- 1. All the connectivity items of Data / Voice / CATV Structured Cabling System.**  
**AVAYO Electronics Canada corporation (Regional Office)**  
P.O.Box: 13044,  
Ajman - U.A.E.  
Tel.: +971 6 7407440  
Fax: +971 6 7407441

### 13. EMERGENCY INFORMATION

Since the Data / Voice / CATV Structured Cabling System comprises of passive components only, no emergency situation for usage of the Cabling system is envisaged.

However in case of emergency due to other related matters following persons may be Contacted:

### 14. MANUFACTURER'S GUARANTEES & WARRANTIES

The AVAYO components installed in this Structured Cabling System project are warranted against any manufacturing defect for a period of 25 years from the date of installation. For the same period, these components are warranted to meet the requirements of TIA 568-A specifications for commercial building cabling, subject to the system and the components being used as installed without any changes. Damages due to reasons beyond the control of the manufacturers and the installers etc. are excluded.

### 15. RECOMMENDED SPARES

Since the system is warranted by AVAYO for 25 years from defects, it is not considered essential that client should hold a stock of spare parts. However if required following space are recommended:

1. 4 Pair Cat 6 UTP cable/305 mtr box – 2 Nos
2. Rj45 Module-Cat6 – 10 Nos
3. Single Bevelled face plate – 10 Nos
4. 24 Port Modular Power Cat6 Keystone Jack Patch panel – 10 Nos
5. Snap in Key stone Jack 568A/568B - 50 Nos
6. Cable Management – 10 Nos