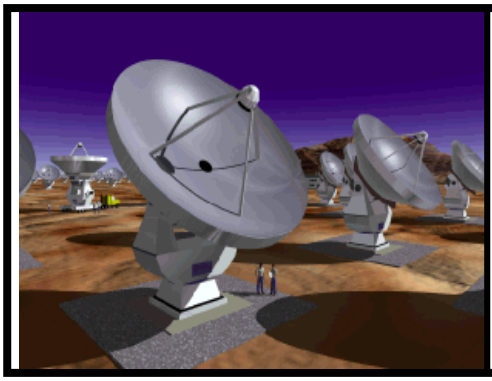

ALMA
Atacama Large Millimeter Array

Hardware Definition
Optical Demultiplexer-Switch Module
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Optical Demultiplexer-Switch Module

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   Reason for / items changed:

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1 OVERVIEW

1.1 General Description of Assembly/Module

The optical demultiplexer switch module (ODSM) demultiplexes the 12 wavelengths on the input fibre onto 12 separate fibres which go, in groups of 3, to the four quadrants of the correlator. Each triple to a quadrant carries the digitised signals from a band-pair. A 3-gang, 4 x 4 optical matrix switch immediately following the demultiplexer allows the triples to be switched to the correlator quadrants in any manner, including, for example, the same triple to all 4 quadrants.

The module is made from a standard optical demultiplexer and three 4 x 4 matrix switches. The latter may be either packaged or composites made from, for example, separate 1:4 splitters and four 4:1 switches. In either case, the internal optical connections will be by splices rather than optical connectors.

The module will be constructed as a plug-in to a crate. Control of the three switches will be ganged and derived from an interface to the CAN bus.

1.2 Sub-assembly A – The optical demultiplexer

The optical demultiplexers used in the system will be passive devices. Athermal devices are commercially available and considered to be the best choice for this application. They will have a channel spacing of 200GHz

1.3 Sub-assembly B – The 4x4 optical matrix switches

This is an optical 4x4 matrix switch. It should have the capacity to switch any combination of inputs to any combination of outputs, including one input to all outputs.
It is a non-standard device and may have to be assembled from component parts or manufactured as a ‘special’. It is likely this device will combine optical 1x4 splitters with mechanical optical 1x4 switches to produce the desired functionality.

1.4 Sub-assembly C – The CAN bus interface card

A CAN bus interface card will be associated with one or several groups of three modules. It will accept switch position commands from the CAN bus and convert them into them into the signals required by the switch. If the switch module offers position sensor outputs these will be converted into CAN bus monitors

The number of groups controlled by each controller depends on the details of the interface to the switch. A complex interface such as that to the Prism switches will require a single controller per group. A simple three wire serial interface will allow the controller to serve perhaps eight groups

2 INTERFACES

List assembly/modules, and their document numbers, which interface to this hardware device.

- Optical fibre amplifier

- Optical receiver board
- CAN bus control
- Power

3 SPECIFICATIONS

3.1 Performance Specifications

3.1.1 General description

The device is optically passive but there are significant optical losses in both the demultiplexer and the matrix switches. The total loss from input to output, at the appropriate wavelengths, may be output and switch-state dependent. If necessary, balancing attenuators may be needed to prevent channel-dependent losses in dynamic range.

There will be crosstalk, largely between adjacent channels, which is governed largely by the demultiplexer. The demultiplexer should be specified to have athermal characteristics and with specified maximum levels of crosstalk.

The switches are opto-mechanical so that reasonable lifetimes will not be consistent with frequent switch operations. Permissible number of switch operations needs to be investigated. If possible, latching switches which only dissipate power whilst switching should be selected.

3.1.1.1 Inputs

- Single optical fibre from the optical fibre amplifier. This fibre will carry 12, wavelength multiplexed channels
- CAN Bus control inputs

3.1.1.2 Outputs

- 12, fibre outputs, each carrying a single demultiplexed wavelength channel to the correlator quadrants.

3.1.2 Sub-assembly A – The optical demultiplexer

3.1.2.1 Inputs

- Single fibre input from the optical fibre amplifier

3.1.2.2 Outputs

- 12 fibre outputs, each carrying a single wavelength channel to the optical switch. Depending on the choice of multiplexer additional, spare channels will be terminated inside the module.
- It will have a channel count of 12 or16 channels
- The channels will be equally spaced on the ITU grid between 1561.42nm and 1530.33nm

3.1.2.3 Performance

- It will have a worst-case insertion loss of 7dB and a worst-case insertion loss uniformity of 1.5dB. By preference the insertion loss will be as low as possible. Larger values of insertion loss uniformity will be considered on merit.
- It will have a worst case PDL of 0.5dB. By preference PDL will be as low as possible.
- Values of PMD and chromatic dispersion will be considered on merit and in consideration of the final design. A typical value for PMD would be 0.3ps and a typical value for chromatic dispersion will be 20ps/nm.
- Return loss will be as high as possible and typical values will be 40dB
- Acceptable levels of crosstalk will be studied in the JBO pre-production test link and individual device values considered on merit. Typical quoted values of -25dB adjacent crosstalk and –28dB non-adjacent crosstalk are acceptable
- Channel bandwidth @-1dB > 200pm

3.1.3 Sub-assembly B , The 4x4 optical matrix switch

3.1.3.1 Inputs

- Four fibre inputs.
- Switch position controls

3.1.3.2 Outputs

- Four fibres

3.1.3.3 Performance

- Insertion loss Max 9.5dB (including connectors). By preference the insertion loss will be as low as possible and as uniform as possible.
- Typical switch repeatability < ±0.02dB (0.5dB max for MEMs 4x4 switches)
- Coupler uniformity < 1dB
- PDL < 0.5dB. By preference this will be as low as possible.
- Return loss will be as high as possible and typical values will be 40dB
- Acceptable levels of crosstalk will be studied in the JBO pre-production test link and individual device values considered on merit. Typical quoted values of -50dB are acceptable.
- Switching speed -TBD
- Typical quoted lifetimes values are 10 million cycles. Further information is pending on switch lifetimes.

3.1.4 Sub-assembly C, The CAN bus interface card

3.1.4.1 Inputs

CAN bus.
Switch position sensors (if available)

3.1.4.2 Outputs

Switch position controls

3.2 Monitor/Control Interface

3.2.1 General

The CAN bus will be converted to one or two SPI busses using a AMBSI2 module . PIC microcontrollers will convert between SPI bus and switch specific signals. These signals will be either single ended CMOS or balanced RS422 depending on length.

List interfaces to sub-assemblies.

3.2.2 Summary of Monitor Points

If monitoring of switch positions is available and is considered worthwhile, each module will provide an eight-bit monitor signal. (Four switches each generating a two-bit signal).

3.2.3 Summary of Control Points

Each group of three modules requires an eight-bit control signal to set the switches. (Four switches each require two bits to set one of four positions)

3.2.4 Monitor Points in Detail

List monitor function, word, bit and timing definitions.

3.2.5 Control Points in Detail

List monitor function, word, bit and timing definitions.

3.3 Physical Specifications

3.3.1 Packaging

3.3.1.1 General

There will be one ODSM assembly per telescope.
It is anticipated that 3, 4x4 matrix switches will be packaged together with the optical demultiplexer and control and power functions as a plug-in to a crate. Each crate will hold 4 ODSMs.

3.3.1.2 Connectors

Connectors will be ALMA standard Diamond E-2000 APC connectors

3.3.1.3 Back panel

A multilayer printed circuit back plane will carry signals between the controller and the switch modules. Power will also be distributed on the backplane.

3.3.1.4 Front panel

Not yet defined

3.3.1.5 Sub-assembly A , The optical demultiplexer

These devices are contained within athermal packaging.
Packing size will vary dependent on manufacturer, but typical dimensions are (WxDxH) 140 x 105 x 15 mm.

3.3.1.6 Sub-assembly B , The 4x4 optical matrix switch

The overall size of one 4x4 matrix switch is estimated at 400x230x80 mm.

3.3.1.7 Sub-assembly C, The CAN Bus interface card

The controller will be assembled on a suitably sized multi layer printed circuit board. It will connect to the CAN bus by a standard 9pin D connector. It will connect to the back plane through a DIN41612 connector.

3.3.2 Power Dissipation and Thermal Interface

Not yet defined

3.3.3 Weight

Not yet defined

4 FUNCTIONAL DESCRIPTION AND BLOCK DIAGRAMS

4.1 General

Define hot swap requirements, if any.

4.2 Sub-assembly A, The optical demultiplexer

4.3 Sub –assembly B, The 4x4 optical matrix switch

4.4 Sub-assembly C, The CAN bus interface card

5 SETUP AND MAINTENANCE

6 REFERENCES

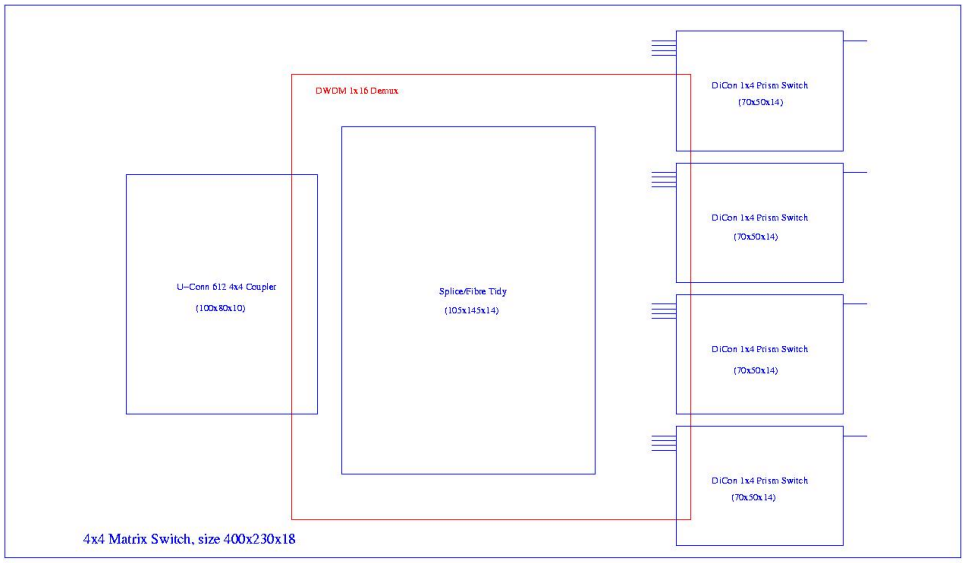
6.1 ALMA Documents

6.2 ALMA Drawings

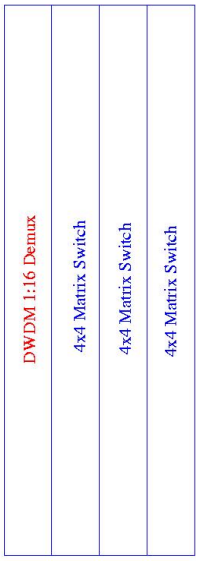
6.3 Other References

7 DRAWINGS

7.1 Block diagram of Sub-assembly B, The 4x4 optical matrix switch



Side View



End View

Overall size: 400x230x80 Will fit in (deep) 6U–4 inch Plugin

8 PHOTOS

9 DATA SHEETS FOR KEY COMPONENTS