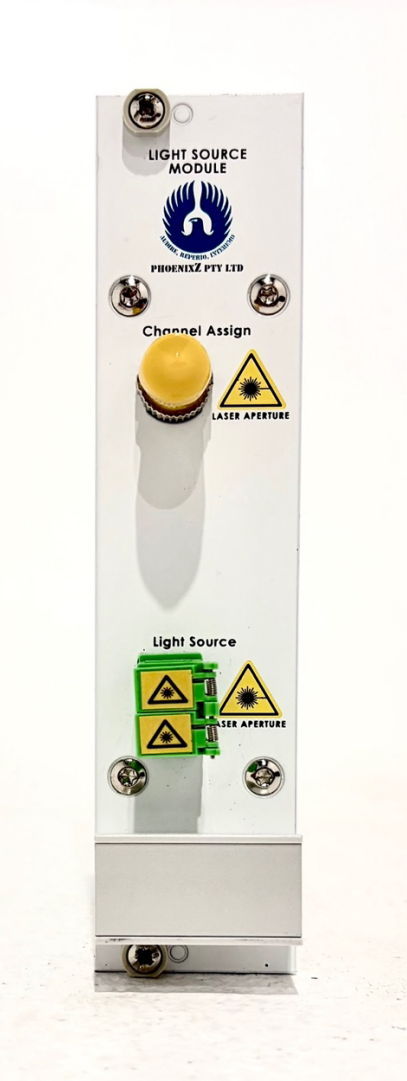
YELLOW FINCH

LIGHT SOURCE MODULE (LSM)



Technical Manual

PHOENIXZ

MANUFACTURER

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REVISION HISTORY

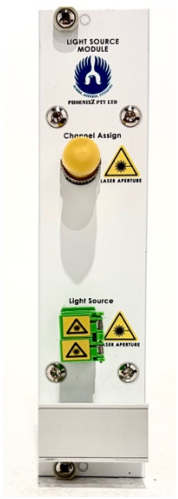
Revision	Date	Description
Rev A	25/05/2026	Initial release

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Introduction

The Light Source Module (LSM) is a subsystem of the Yellow Finch Remote Terminal Unit (RTU) responsible for generating optical power and optical interrogation signals used for operation of Gas Monitoring Stations (GMS).



LSM Front



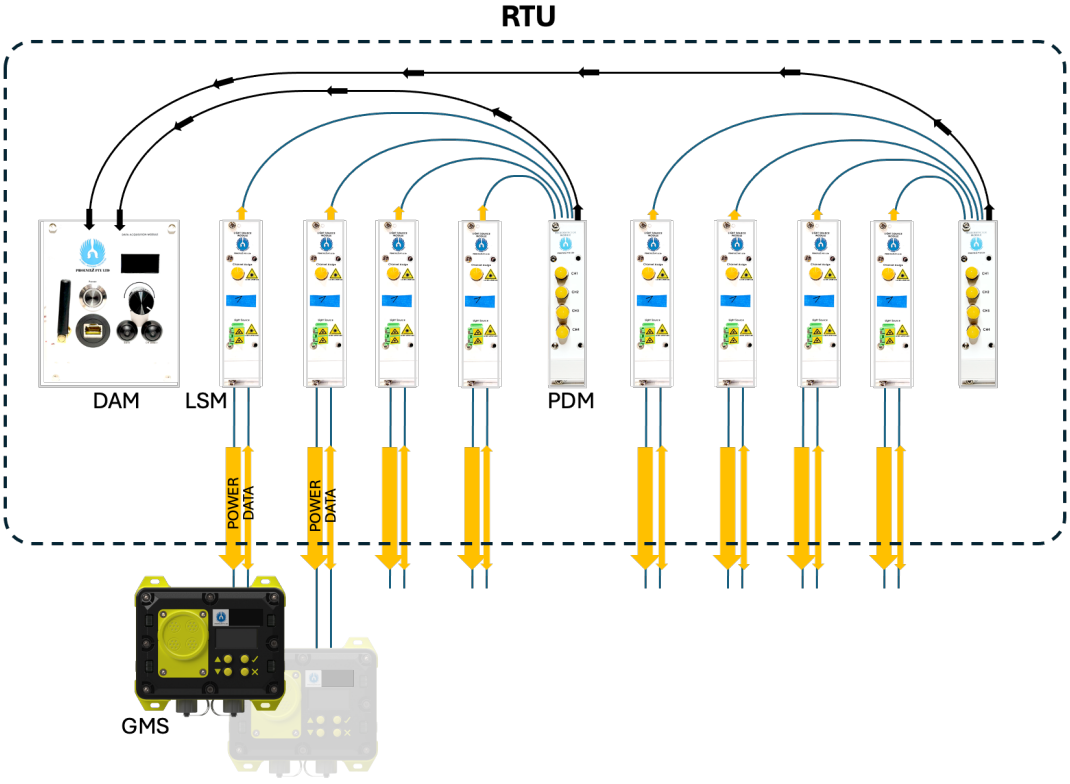
LSM Back



LSM side



The LSM contains three optical outputs and one optical input. One optical output delivers optical power in the form of light to the Gas Monitoring Station (GMS), while the second optical output provides optical interrogation signals for telemetry communication. The returned modulated optical telemetry signal from the GMS is routed through the optical input to the Photodetector Module (PDM), where it is conditioned, converted into the electrical domain, and demodulated.



Main Functions

The LSM performs the following functions:

- Generation of optical power for remote powering of GMS units
- Generation of optical interrogation signals
- Stable optical output control
- Current limiting and optical power protection
- Overcurrent protection
- Distribution of optical signals to connected GMS units
- Routing of returned optical telemetry signals from the GMS units to the Photodetector Module (PDM) for demodulation

The LSM delivers optical radiation exclusively through enclosed fibre-optic interfaces.

Parameter	Specification
Optical wavelength	1510 nm – 1570 nm
Maximum optical output power	140 mW, CW per channel
Fibre type	SMF-28 single-mode fibre
Connector type	LC/APC to GMS
	ST/APC to PDM

The optical output power is electronically limited and continuously monitored by the RTU.

Internal Construction

The LSM contains:

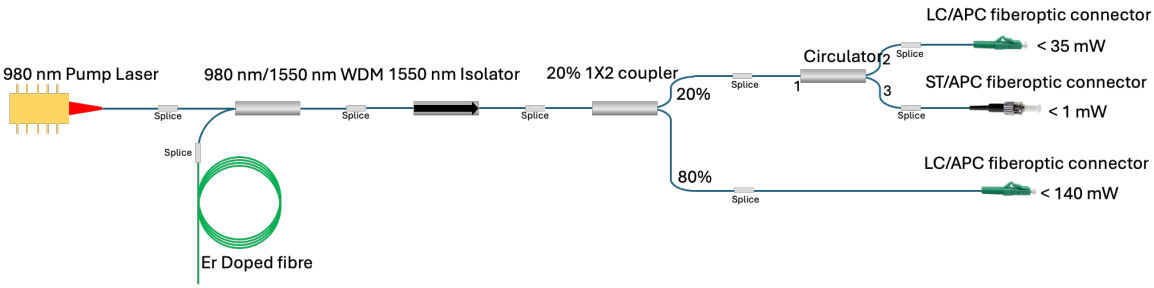
- Amplified Spontaneous Emission (ASE) source — fibre-coupled optical source generating optical power in the wavelength range of 1510 nm to 1570 nm
- Laser driver electronics and thermal management system
- Optical power control circuitry
- Current limiting circuitry
- Optical connectors and fibre-optic circuitry

Fibre-optic circuitry of LSM

The LSM provides controlled optical output delivered through single-mode optical fibre to connected GMS units and routes returned modulated optical telemetry signals from the GMS units to the Photodetector Module (PDM) for demodulation.

The LSM consists of the following components:

- 980 nm fibre Bragg grating (FBG) stabilised pump laser
- Erbium-doped fibre-optic amplifier
- 980 nm / 1550 nm wavelength division multiplexer (WDM)
- 1550 nm fibre-optic isolator
- 1×2 fibre-optic coupler
- Three-port fibre-optic circulator



Light generated by the 980 nm pump laser is launched into the WDM, where it is directed into the erbium-doped fibre-optic amplifier. The erbium-doped fibre amplifier generates optical radiation in the wavelength range of 1510 nm to 1570 nm (C-band).

The WDM passes the C-band optical signal to the fibre-optic isolator while blocking residual 980 nm pump radiation. The fibre-optic isolator prevents reflected optical signals from propagating back into the erbium-doped fibre amplifier, reducing the possibility of optical instability.

Optical output from the isolator is directed into a 1×2 fibre-optic coupler, where the optical signal is split into two paths:

- Optical power delivery path to the GMS power port
- Optical interrogation and telemetry path

The optical split ratio is:

- 80% to the optical power delivery port
- 20% to the telemetry/interrogation path

The optical power delivery path is connected to an LC/APC optical connector.

The telemetry/interrogation path is connected to Port 1 of the three-port fibre-optic circulator. The circulator routes optical interrogation signals from Port 1 to Port 2, which is connected to an LC/APC optical connector interfacing with the GMS telemetry port.

The optical telemetry signal returned from the GMS travels back through the same optical fibre to the circulator, where it is routed from Port 2 to Port 3. Port 3 is connected to an ST/APC optical connector interfacing with the Photodetector Module (PDM).

The returned optical telemetry signal is then converted into the electrical domain, conditioned, and demodulated within the Photodetector Module (PDM) before being transmitted to the Data Acquisition Module (DAM).

Optical Safety

The LSM operates as a fully enclosed fibre-coupled optical system.

Safety features include:

- Current-limited optical outputs
- Fibre-coupled enclosed optical interfaces
- LC/APC connectors with protective covers/shutters
- No accessible free-space optical beam is present during operation

- Installation within the IP54-rated RTU enclosure
- Overcurrent protection
- Automatic optical power shutdown protection
- Permanent fuse protection against excessive optical output power

The LSM incorporates two independent optical safety protection mechanisms:

Automatic optical power shutdown:

The LSM continuously monitors the driving current applied to laser diode. If the current exceeds the current corresponding to the laser output of 145 mW, the protection circuitry automatically disables the optical source.

Permanent fuse protection:

If the primary protection mechanism fails to disable the optical source, an internal fuse operates and permanently disables the LSM, preventing further optical power generation.

The LSM is intended for operation only with connected optical fibre cables.

Communication with DAM

The LSM interfaces directly with the embedded controller located within the Data Acquisition Module (DAM).

Functions monitored by the RTU include:

- Optical output power
- Pump laser drive current
- Module operating status
- Optical channel activity

Installation

The LSM is installed internally within the RTU enclosure and is not user serviceable.

Servicing or replacement shall only be performed by authorized personnel.

Applicable Standards

The LSM is intended for assessment in accordance with:

- IEC 60825-1
- IEC 60825-2
- IEC 60079-28
- IEC 60079-0:2017
- IEC 60079-28:2025

WARNING:

Invisible optical radiation may be present at optical connectors when the system is energized.

Do not inspect optical outputs using optical instruments unless electrical power has been disconnected and the optical source verified de-energized.

Special Conditions of Use

The LSM is intended for operation only within the RTU enclosure and only in a non-hazardous safe area.

The equipment shall be supplied from a PELV or SELV supply with a maximum voltage not exceeding 12.8V and prospective short circuit current not exceeding 50A.

The LSM shall only be operated with:

- Approved optical fibre connections
- LC/APC and ST/APC optical connectors
- SMF-28 single-mode optical fibre or equivalent

The LSM optical interfaces shall remain connected during normal operation.

Optical connectors and fibre ends shall not be inspected using optical instruments while the system is energized.

The LSM shall be installed in accordance with:

- Manufacturer instructions
- Applicable electrical regulations
- Site safety procedures

The enclosure shall remain closed during normal operation.

Servicing shall only be performed by authorized personnel.

Electrical power shall be disconnected before opening the enclosure or servicing optical interfaces.

Damaged optical fibre cables or connectors shall be replaced before operation.

The LSM shall not be modified without approval from PhoenixZ Pty Ltd.
LSM is certified equipment, no modification is allowed without recertification by ExTC

Safety Features

Key safety principles:

- No electrical power distribution underground
- Optical power delivery only
- Surface-located electrical infrastructure
- Current-limited optical outputs
- Enclosed fibre-coupled optical interfaces
- Isolated optical communication interfaces
- Automatic optical power shutdown if optical output exceeds 145 mW
- Permanent fuse protection in the event of primary protection failure

The LSM is designed for operation only within the RTU enclosure located in a non-hazardous safe area.

Installation

The LSM is designed as a removable sliding module installed within the RTU chassis.

Installation procedure:

- Ensure that electrical power to the RTU is disconnected before installation.
- Carefully slide the LSM into the designated mounting position within the RTU chassis.
- Ensure that the module is fully inserted and correctly aligned with the internal electrical and mechanical interfaces of the RTU.
- Secure the LSM in position using the retaining screws located at the top and bottom of the module front panel. The retaining screws shall be fully tightened to prevent movement or accidental removal of the module during operation or transport.
- Connect the optical fibre interfaces to the appropriate optical connectors:
  - LC/APC connectors to GMS optical interfaces
  - ST/APC connector to the Photodetector Module (PDM)
  - Verify that all optical fibre connections are clean, properly aligned, and securely connected.
  - Ensure that optical fibre cables are not subjected to excessive bending, tension, or mechanical stress.
- After installation is completed, electrical power may be restored to the RTU.

The LSM shall only be installed and serviced by authorized personnel.

Maintenance

Recommended maintenance:

- Optical connector inspection
- Fibre cleaning

Storage and Transport

When transporting or storing the LSM:

- Protect optical connectors
- Avoid mechanical shock
- Store in dry environment
- Use protective transport case

Product Labels

The RTU includes:

- Product identification label at the back of RTU
- Serial number label combined with Product identification label
- Optical warning labels next to the optical outputs of the LSM
- Power input label





Product identification label
Serial number label
Electrical input label

Laser warning label