VIBRATION MONITORING OF FANS INSTALLED IN ROAD TUNNELS

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INSTRUMENT FOR MONITORING VIBRATIONS OF FANS INSTALLED IN ROAD TUNNELS

PURPOSE OF THE INSTRUMENT

The instrument measures and monitors the vibrations of each fan installed. It allows checking for correct machine operation over a period of time thus preventing catastrophic failures.

Hence it is possible to stop the fan when the vibrations exceed a preset value and to schedule maintenance work in order to replace damage parts as well as to clean the blades (uneven deposits would generate unbalances and therefore vibrations) or to check the fan fastenings, etc.

1. TECHNICAL DESCRIPTION OF THE SYSTEM

1.1. GENERAL

A seismic vibration transducer is installed on the housing for each fan according to any radial direction at random.
The signal generated by the transducer is sent to an electronic processing unit.
Connection is via a suitably sized shielded cable (up to 200 metres 2x1mm^2 - up to 400 metres 2x1.5mm^2 - up to 800 metres 2x12.5m^2).
The processing unit is normally installed in the centre of gravity position with respect to the tunnel section where the monitored fans are installed.

1.2. VIBRATION TRADUCERS

1.2.1. Type of transducer.

The transducer is of the electrodynamic seismic type (velocity transducer), i.e. designed for measuring the speed of vibration parameters; there are no amplifying or signal linearizing circuits incorporated in the transducer).

1.2.2. Frequency range.

Frequency response of the transducer is linear in the range from 10 to 1000 Hz .

1.2.3. Temperature limits.

The transducers should be able to operate correctly in the temperature range from – 10°C to + 100°C.

1.2.4. **Resistance to environmental agents.**
The transducer should be tightly sealed and insensitive to ambient humidity (max. 25%) and resistance to contamination by dusts and lubricating oils with a degree of protection IP 65 (CEI standards)

1.2.5. **Cables and connectors.**
The transducers are complete with male-female connection to MIL standards, able to withstand the mechanical and thermal stresses described in points 1.2.3 and 1.2.4.

1.2.6. **Mounting.**
It should be possible to install the transducer in any direction and fasten it with a sufficiently rugged screw (e.g. M8 thread).

TEST INSTRUMENTS

1.3.1. **Types of instruments.**
All instruments are fully transistorized and the signal coming from a transducer is sent to the respective conditioning and measuring circuit. The scanning system is not permissible.

1.3.2. **Measurement range.**
The instrument should allow measurement and supervision of the RMS value of the vibration speed within a range from 0 to 10 mm/s.

1.3.3. **Frequency range.**
The instrument response is linear in a frequency range from 10 to 1000 Hz.

1.3.4. **Threshold discriminator circuit.**
Each measuring channel is provided with a threshold discriminator circuit of static type with amplitude comparator, suitable for driving an output relay (SPDT contact) and indicator lamp (LED).
The tripping level of the alarm threshold is adjustable between 10% and 100% of the measuring scale.
The alarm threshold is provided with a time delay device, independent from the value and adjustable from 0 to 20 seconds.
The system output logic is as follows: under normal condition (vibration level below the threshold) the relay is de-energized and the LED is unlit. The alarm threshold is of the “unlatched” type, i.e. the output relay remains energized and the relative LED is lit up only as long as the input signal is higher than the threshold value.

1.3.5. **Analog output**.
Each vibration channel sends an output signal 4 to 20 mA proportional to the RMS value of the vibration speed measured.

1.3.6. **Environmental conditions**.
The instruments operate correctly within a temperature range from –10°C to + 50°C.

1.3.7. **Power supply.**
Instrument power supply is 220 Vac – 50 Hz

1.3.8. **Composition of the instruments.**
Each instrument is mounted in a 19" rack enclosure able to process at least 16 measuring channels. The following are installed in the unit:
- one power supply complete with main switch
- a number of signal processing boards which depend on the number of fans to be monitored.

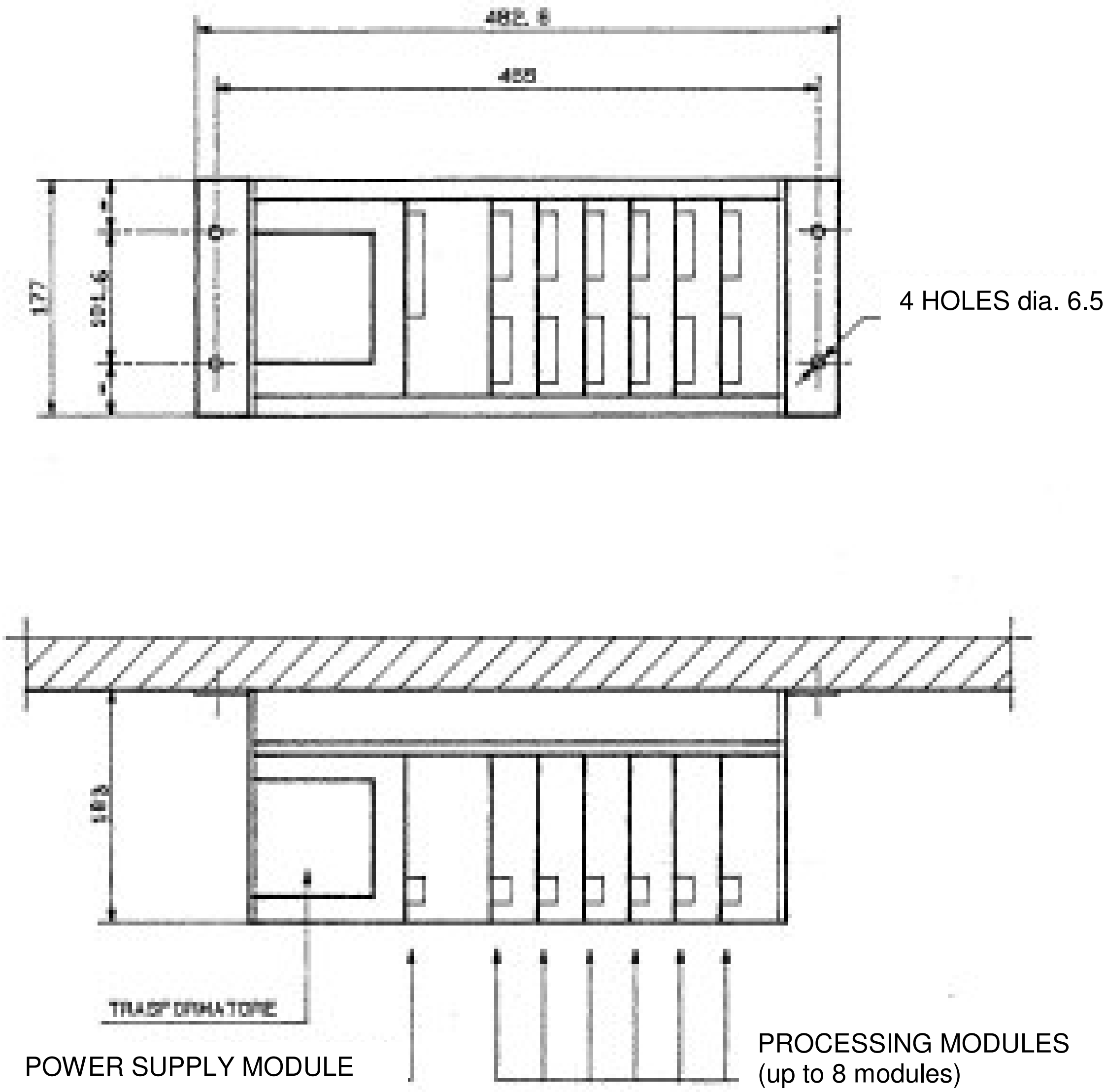
POWER SUPPLY MODULE PW T1-C

FUNCTION

Power supply module PW T1-C is able to supply stabilized voltage up to 8 processing modules T1-C. The power supply is mounted in a wall-mounted unit.
The instrument can be mounted in suitable enclosure with degree of protection IP54 for applications in protected environment.

TECHNICAL CHARACTERISTICS

External connections	: terminal board WEIDMULLER TOP 1,5 GS
Supply voltage	: 100 – 220 V 50 Hz ± 10%
Max. power consumption	: 50 VA
Output voltages	: + 15 V - 15 V
Max. output currents	: + 15 V = 1 A - 15 V = 0.5 A
Unit	: dwg. 23950



REVISIONI: A, B, C

SOST. IL | SOST. DAL | DISEGNATO | DATA | VISTO | SCALA

C E M B

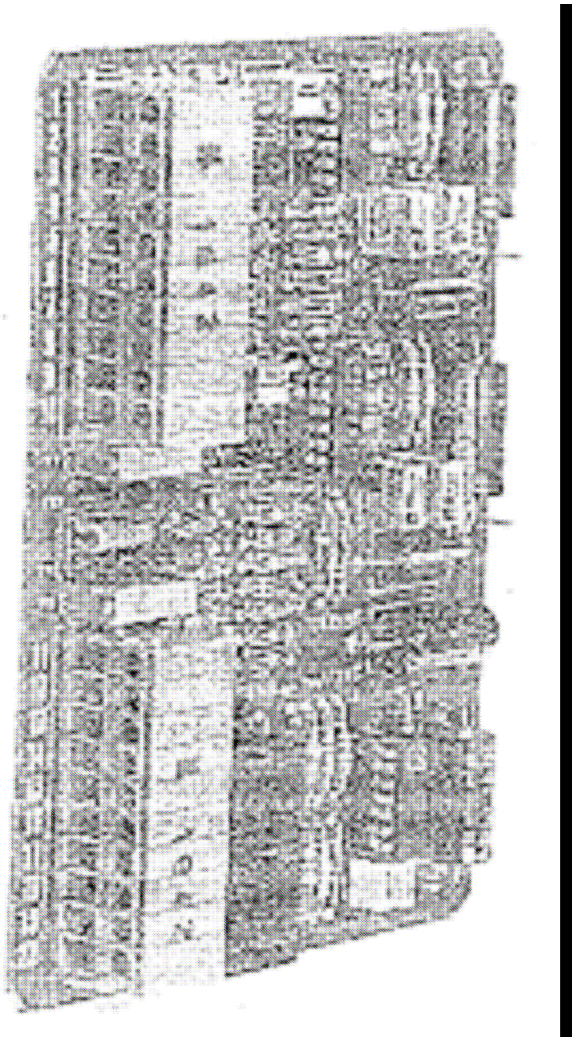
Costruzioni Elettro Meccaniche
Ing. Buzzi e C. - S.p.A.
MANDELLO DEL LARIO (CO) - ITALY

T1 - C

OVERALL DIMENSIONS
PROCESSING RACK

DIS. Nr. 23950-P

PROCESSING MODULE T1-C

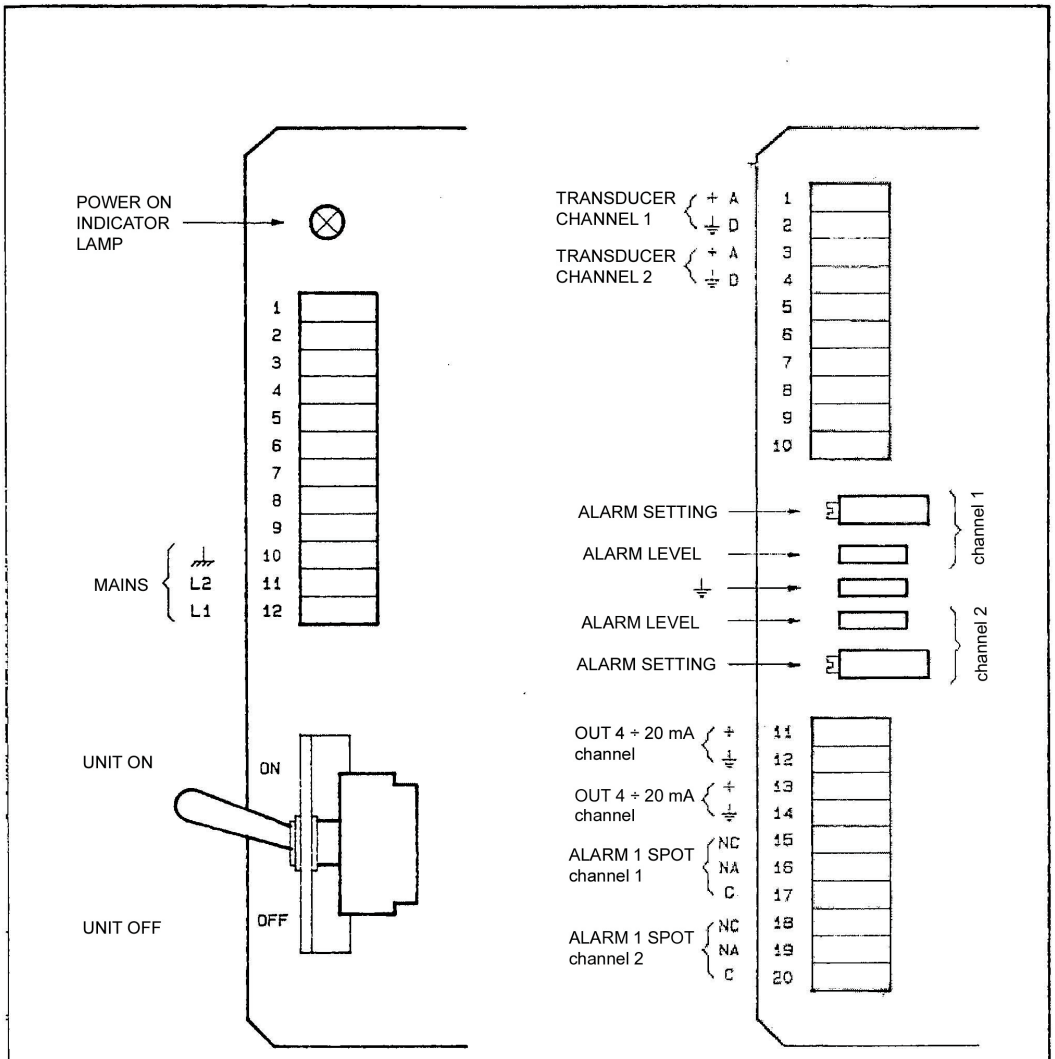


FUNCTION

The T1-C processing module is able to process the signals coming from two vibration transducers type T1-40 and to supply, for each signal, an analog output and an alarm contact. The module can supply the analog outputs proportional to the axial position or speed of vibration.
Such module is extremely compact in design while it allows simple and modular monitoring of the vibrations.

TECHNICAL CHARACTERISTICS

External connections	: terminal board WEIDMULLER TOP 1,5 GS
Supply voltage	: + 15 V / - 15 V
Max. current drawn	: + 15 V = 120 A - 15 V = 16 A:
N° of channels processed	: 2
Unit of measurement of vibration	: 0 to 100 µm, 0 to 300 µm 0 to 10 mm/sec 0 to 30 mm/sec
Output signals (terminals OUT1 and OUT2)	: 4 TO 20 mA proportional to the input vibration
Alarm contacts (terminals ALARM 1 – ALARM 2)	: 1 SPDT for each channel
Max. current, alarm contacts	: 3A
Max. voltage, alarm contacts	: 250 V
Alarm adjustment	: 0 to 100% of the measurement range
Alarm delay time	: from 0 to 20 seconds (approx.)
Alarm condition indicator	: Red LED located close to the alarm level setting potentiometer



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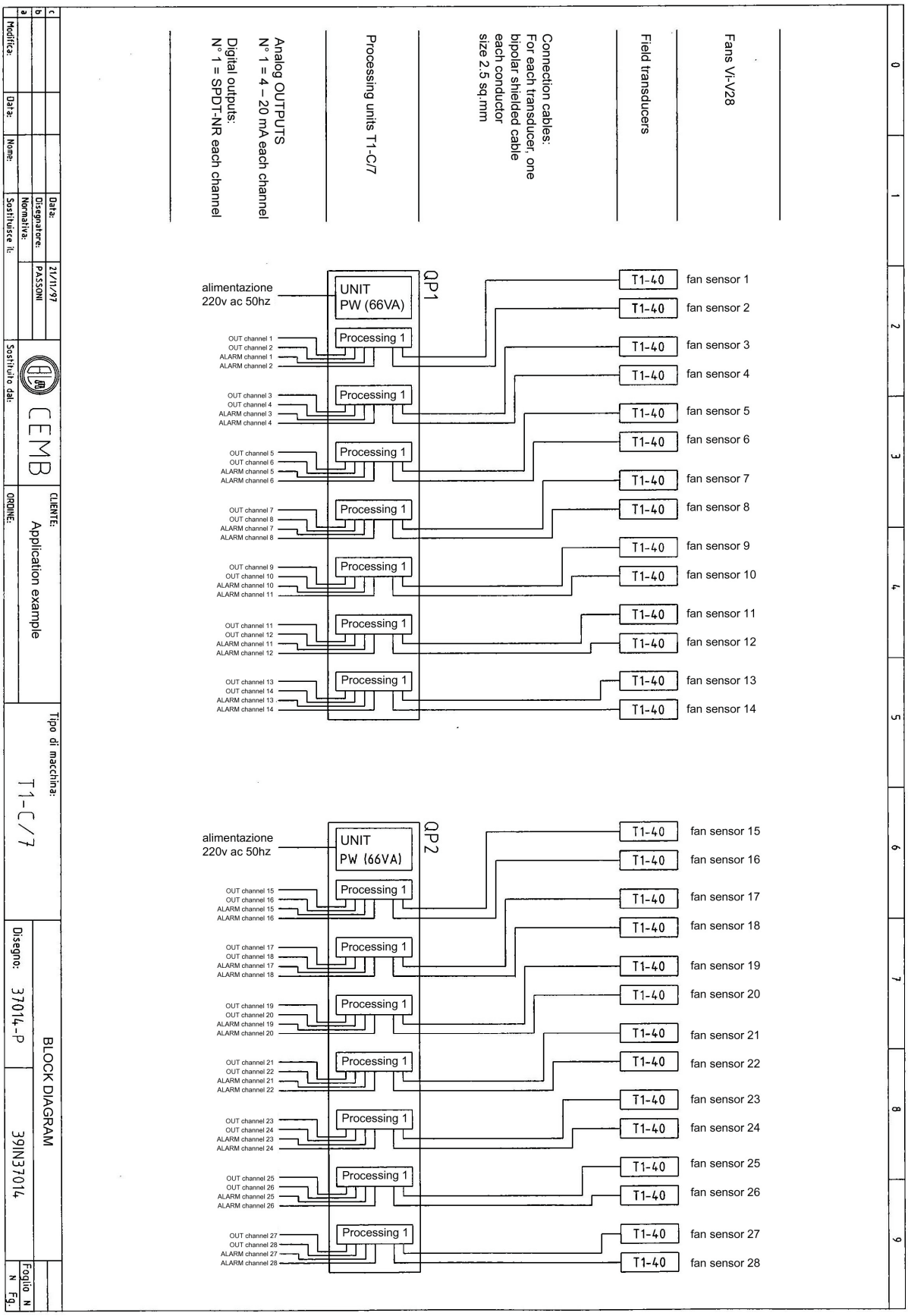
T1 - C

LAYOUT
TEST AND CONNECTIONS

DIS. Nr. 23954-P


Fans Vi-V28
Field transducers
Connection cables:
For each transducer, one
bipolar shielded cable
each conductor
size 2.5 sq.mm
Processing units T1-C/7
Analog OUTPUTS
N° 1 = 4 – 20 mA each channel
Digital outputs:
N° 1 = SPDT-NR each channel
QP1
alimentazione
220v ac 50hz
UNIT
PW (66VA)
Processing 1
OUT channel 1
OUT channel 2
ALARM channel 1
ALARM channel 2
OUT channel 3
OUT channel 4
ALARM channel 3
ALARM channel 4
OUT channel 5
OUT channel 6
ALARM channel 5
ALARM channel 6
OUT channel 7
OUT channel 8
ALARM channel 7
ALARM channel 8
OUT channel 9
OUT channel 10
ALARM channel 10
ALARM channel 11
OUT channel 11
OUT channel 12
ALARM channel 11
ALARM channel 12
OUT channel 13
OUT channel 14
ALARM channel 13
ALARM channel 14
T1-40
fan sensor 1
fan sensor 2
fan sensor 3
fan sensor 4
fan sensor 5
fan sensor 6
fan sensor 7
fan sensor 8
fan sensor 9
fan sensor 10
fan sensor 11
fan sensor 12
fan sensor 13
fan sensor 14
QP2
alimentazione
220v ac 50hz
UNIT
PW (66VA)
Processing 1
OUT channel 15
OUT channel 16
ALARM channel 15
ALARM channel 16
OUT channel 17
OUT channel 18
ALARM channel 17
ALARM channel 18
OUT channel 19
OUT channel 20
ALARM channel 19
ALARM channel 20
OUT channel 21
OUT channel 22
ALARM channel 21
ALARM channel 22
OUT channel 23
OUT channel 24
ALARM channel 23
ALARM channel 24
OUT channel 25
OUT channel 26
ALARM channel 25
ALARM channel 26
OUT channel 27
OUT channel 28
ALARM channel 27
ALARM channel 28
T1-40
fan sensor 15
fan sensor 16
fan sensor 17
fan sensor 18
fan sensor 19
fan sensor 20
fan sensor 21
fan sensor 22
fan sensor 23
fan sensor 24
fan sensor 25
fan sensor 26
fan sensor 27
fan sensor 28
Modifica:
Data:
Nome:
Sostituisce il:
Data:
21/11/97
Disegnatore:
PASSONI
Normativa:
Sostituito dal:
CEMB
CLIENTE:
Application example
ORDINE:
Tipo di macchina:
T1-C/7
BLOCK DIAGRAM
Disegno:
37014-P
39IN37014
Foglio N
Fg.