IEC 62343-5-1

Edition 1.0 2009-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Dynamic modules – Test methods –
Part 5-1: Dynamic gain tilt equalizer – Response time measurement

Modules dynamiques – Méthodes d'essai –
Partie 5-1: Egaliseur dynamique de basculement de gain – Mesure du temps de réponse

IEC 62343-5-1:2009-06(en-fr)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX **R**

ICS 33.180.01; 33.180.99

ISBN 978-2-8891-0679-0

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CONTENTS

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DYNAMIC MODULES – TEST METHODS –

Part 5-1: Dynamic gain tilt equalizer – Response time measurement

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International Standard IEC 62343-5-1 has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This bilingual version (2014-07) corresponds to the English version, published in 2009-06.

The text of this standard is based on the following documents:

FDIS	Report on voting
86C/883/FDIS	86C/899/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 62343 series, published under the general title *Dynamic modules – Test methods,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,
- replaced by a revised edition, or
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DYNAMIC MODULES –
TEST METHODS –

Part 5-1: Dynamic gain tilt equalizer –
Response time measurement

1 Scope and general information

1.1 Scope

This part of IEC 62343 contains the measurement method of response time for a dynamic gain tilt equalizer (DGTE) to change its gain tilt from an arbitrary initial value to a desired target value.

1.2 General information

The DGTE is categorized into three control methods as shown in Table 1. The direct control type is driven directly by voltage or current, the digital control type is operated by digital control system with digital signals, and the analogue control type is operated by analogue signals. The definition and the measurement method of response time for DGTE are different for the three control types. Table1 also shows the configuration of operating systems and the correction for temperature dependency for three control types of DGTE. When the response time for the DGTE has temperature dependency, users may need to calibrate the temperature effect. The bottom row in Table 1 indicates the typical methods of the correction for temperature dependency (refer to Annex D).

Table 1 – Categorization of DGTE by the control method

	Direct control	Digital control	Analogue control
Control	By voltage or current directly	By command through digital circuit	By voltage or current through analogue circuit
Configurations	DGTE V/I applied Control system	DGTE w/digital circuit Command (RS232c, I2C, Control system	DGTE w/analogue circuit V/I control (ex. 0~+5V) Control system
Correction for temperature dependency	By control system	By digital circuit or control system	By analogue circuit or control system

2 Terms, definitions, abbreviations and response waveforms

2.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1.1
convergence time
T_{c}
time to converge from the first hit at the target ±Y % to the stay within the deviation ±Y % in the optical power from the output port of DGTE at pre-determined wavelength

2.1.2
latency time
T_{l}
for the direct and the analogue control types, time between the application of control signal and the change in optical power by ±X % from the output port of DGTE at pre-determined wavelength

2.1.3
processing time
T_{p}
for the digital control type, time between the application of control command and the change in optical power by ±X % from the output port of DGTE at pre-determined wavelength

2.1.4
response time
$(T_{l}$ or $T_{p}) + T_{r} + T_{c}$

2.1.5
rise time
T_{r}
time to change from the initial ±X % to the target ±Y % in the optical power from the output port of DGTE at pre-determined wavelength

2.1.6
setting time
T_{s}
time to be suppressed from the first hit at the target ±Y % to the final stay at the target within a required resolution of the optical power from the output port of DGTE at pre-determined wavelength

2.2 Abbreviations

CPU	Central processing unit
DGTE	Dynamic gain tilt equalizer
DUT	Device under test
O/E	Optical-to-electrical
PDL	Polarization dependent loss
TLS	Tunable laser source
WDM	Wavelength division multiplexing

2.3 Response waveforms

The definitions and symbols defined in 2.1 are shown in Figures 1 through Figure 3.

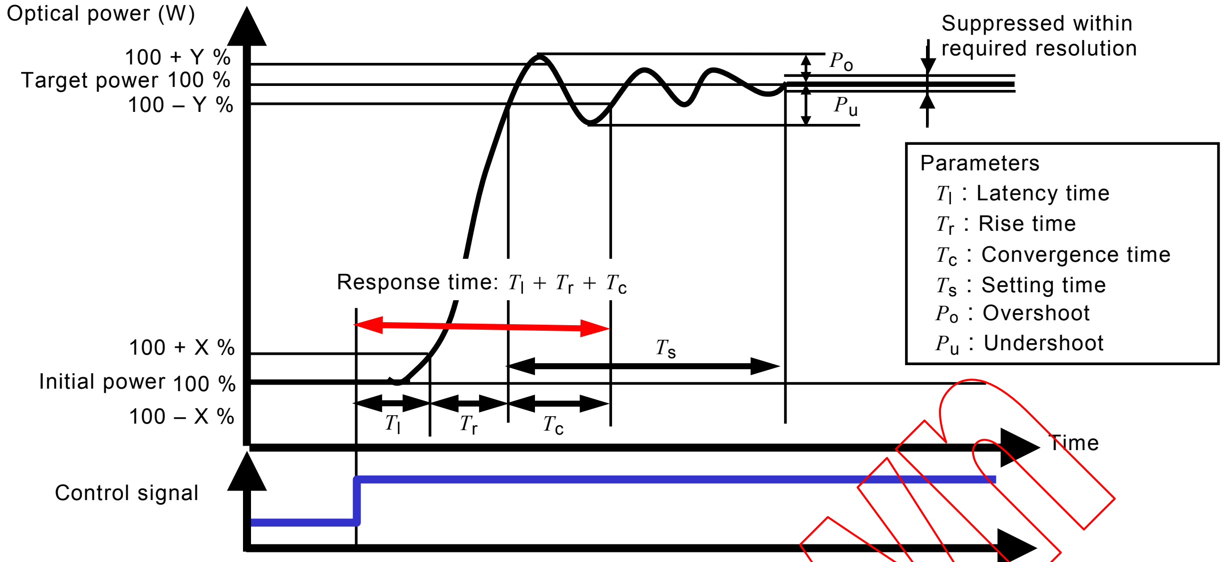


Figure 1 – Response waveforms for direct control DGTEs

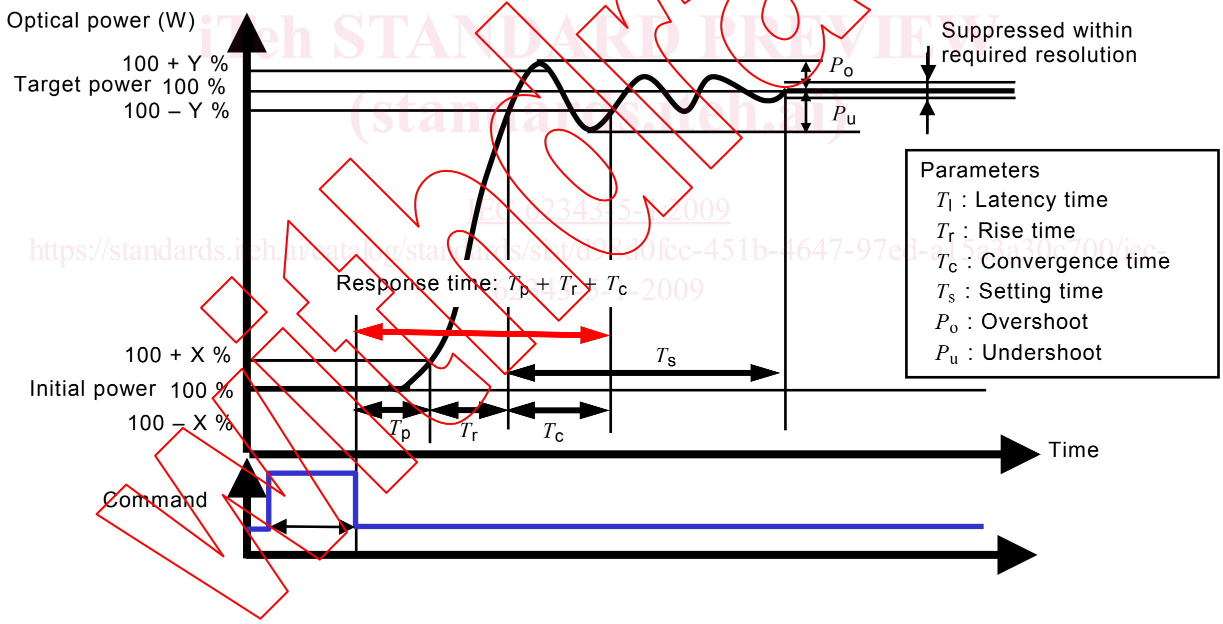


Figure 2 – Response waveforms for digital control DGTEs

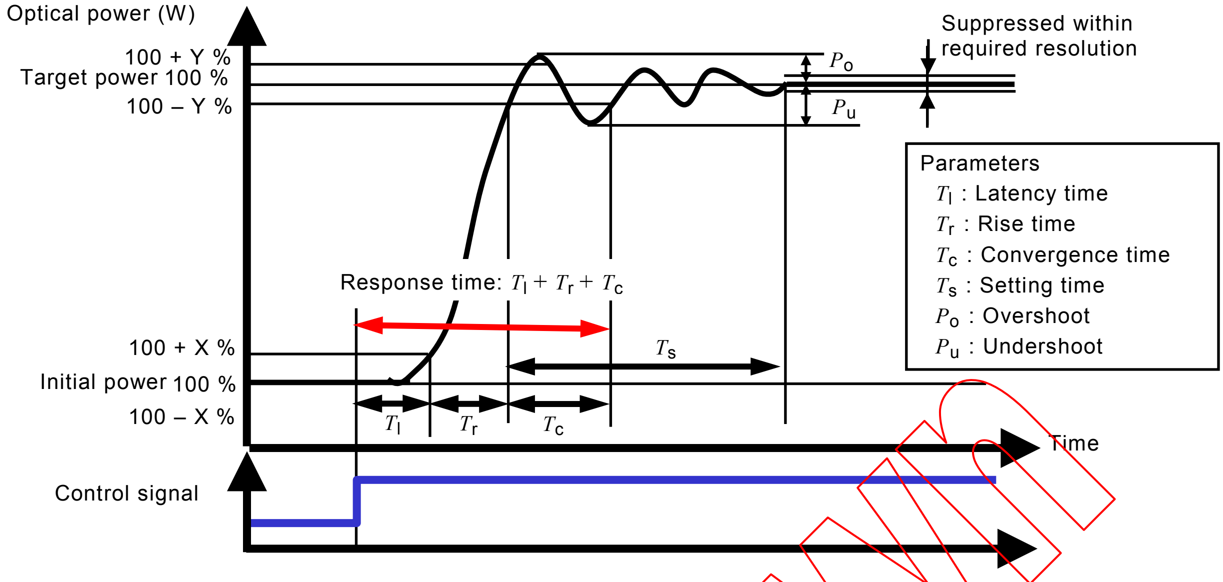


Figure 3 – Response waveforms for analogue control DGTEs

3 Apparatus

3.1 Light source

A tunable wavelength device is used as the light source. A tunable laser source (TLS) or a combination of a broadband light source and tunable filter is the typical equipment of a tunable wavelength light source. The tuning range of the tunable wavelength light source shall be enough to cover the operating wavelength of DGTE to be measured.

In order to minimize the measurement uncertainty caused by the linewidth of the light source, the linewidth multiplied by the maximum value of the gain tilt slope of DGTE shall be smaller than one-tenth of the dynamic gain tilt range. Typical values of operating wavelength range and dynamic gain tilt range of DGTE are 35 nm and ± 4 dB respectively. For example, the error for the linewidth of 1 nm is calculated as:

$$(1)\frac{4/35}{(+4-(-4))}) = 1{,}4\ \%$$

The output power of the light source shall remain stable during the measurement. The stability of the output power during the response time of DGTE to be measured shall be smaller than one-tenth of dynamic gain tilt range of DGTE.

If polarization dependent loss (PDL) of DGTE to be measured is larger than 0,5 dB, a de-polarized light source shall be used.

3.2 Pulse generator

A pulse generator is used to drive the DGTE to be measured. The shape of the pulse shall be rectangular to change the gain tilt. The intensity and width of the pulse shall be such to make the maximum tilt change defined as the specification of DGTE. The rise time/fall time of the rectangular pulse shall be shorter than 10 ns or one-tenth of the rise time/fall time to be measured.

3.3 O/E converter

An O/E converter is used to convert the optical output power of the DGTE to be measured to the electrical power to be observed by an oscilloscope. The bandwidth of O/E converter shall be from DC to greater than $10(1/T_r)$ Hz, where T_r is the rise time to be measured.

The maximum power input to the O/E converter before compression shall be more than 10 times the optical power to be measured.

3.4 Temperature and humidity chamber

The test set-up shall include an environmental chamber capable of producing and maintaining the specified temperature and/or humidity.

3.5 Oscilloscope

The oscilloscope shall have a storage function and sufficient bandwidth and accuracy. It shall have at least two traces.

3.6 Temporary joints

This is a method, device, or mechanical fixture for temporarily aligning two fibre ends into a reproducible, low loss joint. It may be, for example, a precision V-groove vacuum chuck, micromanipulator or a fusion or mechanical splice. The stability of the temporary joint shall be compatible with the measurement precision required.

3.7 Control system

For digital and analogue control types, the control system is used to drive the DGTE. The specification is defined individually.

3.8 Measurement set-up

The measurement set-up for the three control types is shown in Figures 4 to Figure 6.

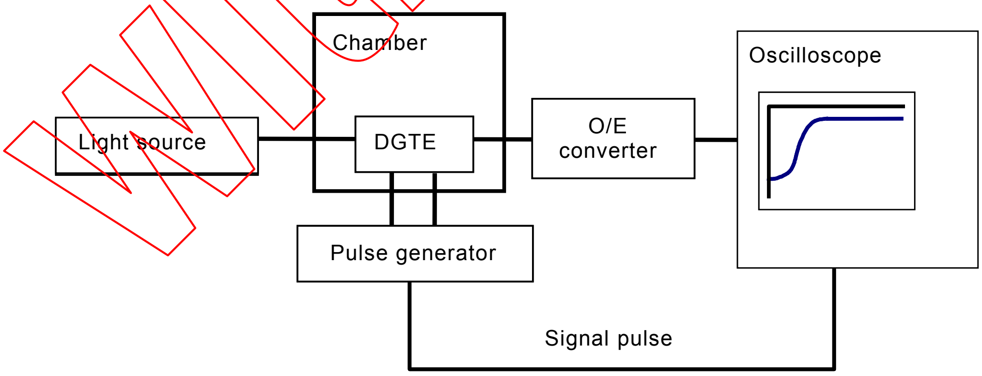
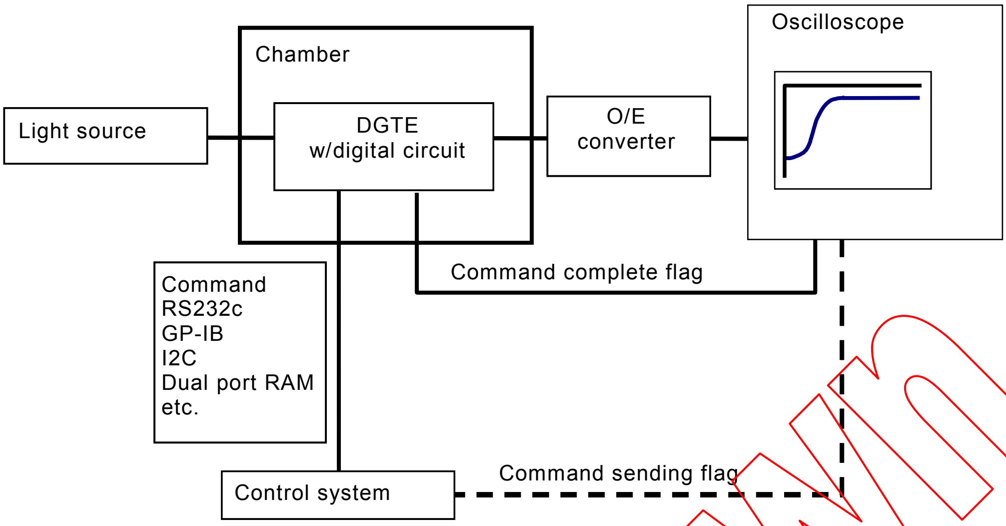
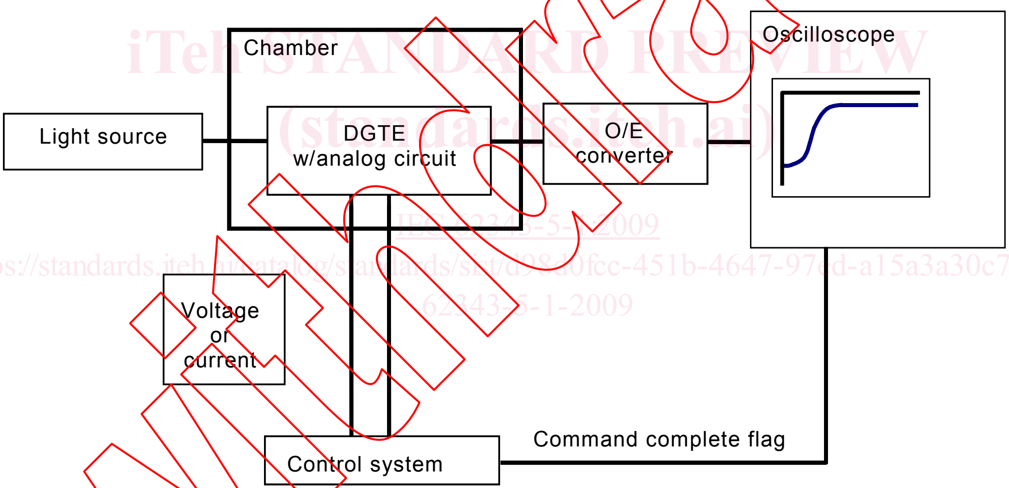


Figure 4 – Measurement set-up for direct control



NOTE Either command complete flag or command sending flag can be used.

Figure 5 – Measurement set-up for digital control



NOTE It should be driven by a step signal from the control system.

Figure 6 – Measurement set-up for analogue control

4 Procedure

4.1 Direct control type

4.1.1 Set-up

The measurement set-up shall be made up as shown in Figure 1. The temperature in the chamber after setting shall be kept constant and uniform in order to achieve stable measurement. The light source, the pulse generator, the O/E converter and the oscilloscope shall be turned on for the measurement.