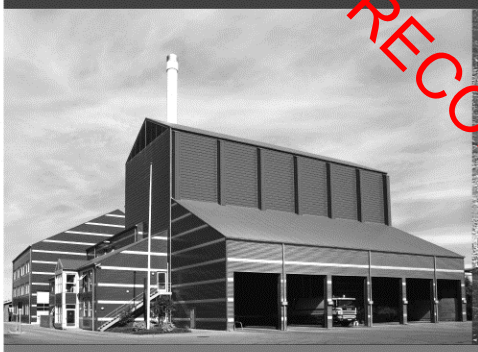
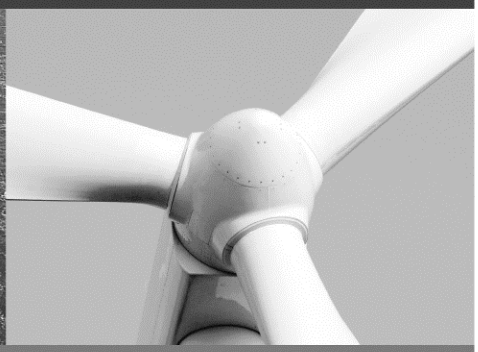
DEIF

-power in control

CE

DATA SHEET





DELOMATIC 4, DM-4 HYDRO

Application

- Hydro turbine generator controller for fully automated operation
- Control of the system's valves, pressures, bearings, speed etc.
- Remote access via TCP/IP

Setup

- Modular I/O
- Combi-I/O module for standard I/O (temp., analogue I/O, digital I/O)
- Only three module types needed to set up a complex control system
- Double euro format (6HE) rack in two standard sizes of 42 and 60TE
- Configurable, ready-made application software
- Local or remote operation using standard PCs or touch panel PCs

Features

- Start/stop turbine
- Synchronising
- Speed control
- Power control with ramp function
- Water level control
- AVR and CosPhi control
- Control of up to 6 speed control valves
- Main valve control
- Mains protection
- Advanced generator protection
- Built-in trending functionality
- Logbooks with more than 200 entries each
- Peak shaving
- 4 pulse counters (e.g. kWh counter)
- communication to www

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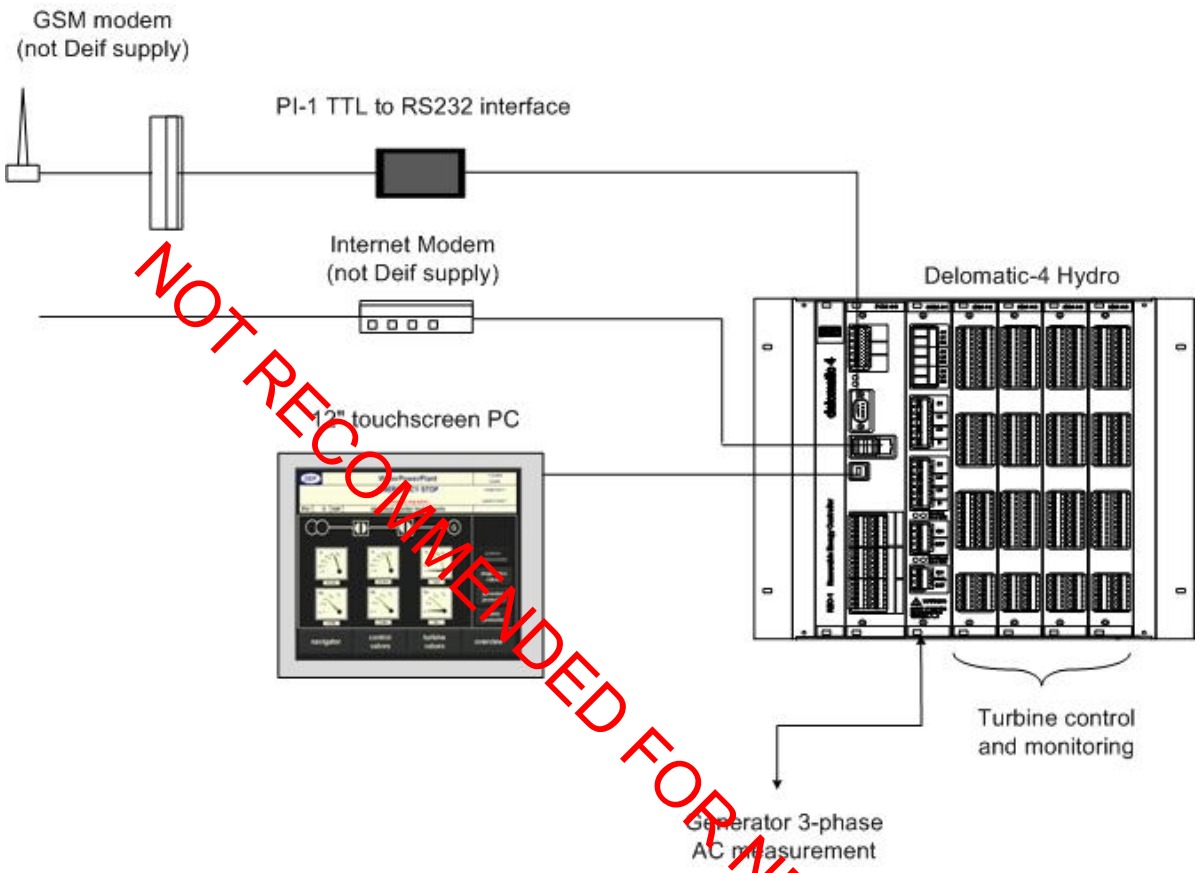
Hardware

The DM-4 Hydro delivery from DEIF consists of:

- DM-4 Hydro 19” rack
- 12” touch screen PC



Application

The controller DM-4 Hydro is designed as a modular process controller. It covers the special demands of renewable energy plants regarding reliability, robustness, flexibility, and remote accessibility in an optimal way.

Based on an existing generator control system approved for marine applications and used in thousands of ships and land-based power stations over the last 25 years, DM-4 Hydro matches the special demands of harsh environments and far-away-locations faced in the land-based decentralised renewable energy generation.

The control of a hydro turbine is designed for unmanned operation. The user interface provides full information to the user and allows an efficient diagnosis and a fast reestablishment of the operation locally as well as remotely.

Properties

The system DM-4 Hydro covers the following functions as a standard:

Measurements:

- Generator voltages three-phase L1, L2, L3, N
- Mains voltages three-phase L1, L2, L3, N
- Currents L1, L2, L3
- Active power per phase/total
- Reactive power per phase/total
- Active and reactive energy counter
- Operating hours
- Circuit breaker operations counter
- Temperatures and pressures at the turbine
- Measurement values of the plant

Protection functions:

- Mains protection
- Vector jump
- df/dt (R.O.C.O.F.)
- Support of a hardware safety chain with reset function
- Electrical protections generator over- and undervoltage, over- and underfrequency, current asymmetry, overload, reverse power, minimum power, overcurrent, thermal overcurrent, overexcitation, loss of excitation
- Overspeed
- Wire-break proof supervision of the breaker position
- Supervision of hydraulic oil pressure
- Supervision of room temperature
- Supervision of pressure of the water inlet line
- Emergency stop
- Water level monitoring for de-rating of generator by dropping level
- Supervision of main valve
- Supervision of control valve(s)
- Tooth-on-tooth supervision of turbine runup speed
- Level supervision in external oil containers (lube oil, hydraulic oil)
- Configurable inputs for fault messages (e.g. for digital auxiliary contacts of automatic cut-outs and motor-protection breakers)

User interface:

- Display of all measurements as graphics and in numbers
- Visualisation of the states of the protections
- Trending function
- Logbooks with more than 200 entries with time stamps each
- Adjustment of parameters
- Multi-user function with standard hardware as touch screens, laptop computers for direct access (USB, TCP/IP)
- Remote access (TCP/IP)
- “Living” P&I diagrams on the screen shows changes and states of components in graphics
- Operation of the plant
- Maintenance calls after operating hours, adjustable

Control functions:

- Fully automated turbine start/stop
- Synchronisation with voltage adjustment and time supervision
- Speed governor with speed ramping function
- Power ramp function for smooth start and stop
- Prerun and postrun of auxiliaries
- Load reduction function due to generator temperature, control valve position and room air temperature
- Operation of motorised circuit breakers
- Analogue power setpoint
- Peak shaving
- Water level controlled operation
- Voltage adjustment and CosPhi control
- Control of the room temperature
- Support of a safety chain
- Demand signal to a hydraulic power pack

Typical Scope of Delivery:

- DM-4 Hydro hardware
- Touch panel PC if desired
- Example wiring diagram
- I/O list
- List of error messages
- Commissioning check list
- P&ID example
- Handbook

System components

The whole DM-4 Hydro system consists of only three modules in a unique way. Each module contains its own processor, therefore it works independently.

All three modules will be delivered in a standard industry rack. Each rack contains one PCM module and a selectable number of SCM modules (mainly 1) and I/O modules (variable). Available standard sizes:

- 24 TE for 2 modules
- 42 TE for 3 to 5 modules
- 60 TE for 6 to 8 modules

A standard configuration for a hydro turbine generator covers e.g. the following components in a 42TE rack:

- 1 PCM 4.3
- 1 SCM 4.1
- 3 IOM 4.2

PCM 4.3

The PCM 4.3 is power supply and main control module of the DM-4 Hydro system with a module width of 8TE. It is mounted leftmost in the rack. It supplies all other modules in the rack and controls the data exchange on the backplane. Furthermore, it bears the control unit with the application software and the following interfaces:

- 3 CAN interfaces 125...1000 kBd
- 1 RS485 interface 9600...38400 Bd
- 1 ARC-net interface 2.5 MBd
- 1 USB interface
- 1 Ethernet 10/100 MBd
- 1 serial port (9600...38400 Bd TTL) for a GSM modem connection (SMS alarming)

In a plant control system, the module behaves as central control. The application software is located in this module; therefore it determines the overall functionality of the plant.

SCM 4.1

The SCM module is used for the measurement of electrical values and execution of fast protections and control functions. It measures voltages up to 690V AC (three-phase) directly (L1 L2 L3 N generator, L1 L2 L3 N mains/busbar). It performs an independent synchrocheck function, can directly trip the circuit breaker and evaluates the breaker feedbacks. Three-phase currents are captured via CTs (1 A or 5 A sec). The SCM module offers a certified measurement of voltage, current, frequency, active power, reactive power, and phase angle at class 0.5 between 40 and 70 Hz.

The measurements are transferred to the PCM module once per period where further protection functions, trending, and logging are located as a part of the application software.

IOM 4.2

The IOM is a multi-functional I/O module for connection of different sensor types. It also interfaces to other systems by standard analogue and digital signals. The module offers:

- **6 inputs for temperature,** Pt100 in 2-, 3-, or 4-wire technique or thermocouples type K (NiCr/Ni)
- **4 analogue inputs** -20...+20 mA with 12 bits resolution
- **4 analogue outputs** for transducer signals or setpoint signals, burden up to 500 Ohms, output range -20...+20 mA, resolution 10 bits for connection of speed governors, AVRs, or frequency converters.
- **12 digital inputs**, 9…36V DC with common potential for sensors switching to plus or minus.
- **4 individual galvanically separated digital inputs**, 9…36 V, for the evaluation of sensor or pulse signals (1.25 MHz sampling rate).
- **10 digital outputs** with external power supply 9…36V DC, push-pull outputs with a stable operation against GND and against supply voltage up to 200mA continuously. The outputs are continuously short-circuit proof and furthermore protected against thermal overload.
- Each board possesses an own galvanic separation between analogue I/O, digital I/O and internal potential. This avoids loops through several boards.

User interface

The DM-4 Hydro system shows a unique user interface that allows running the operating terminal function on any standard Windows PC like industrial touch-panel PCs and laptop computers. All possibilities for local and remote access wire-less or wire-bound can be used because the connection can use Ethernet or directly USB to the PCM module.

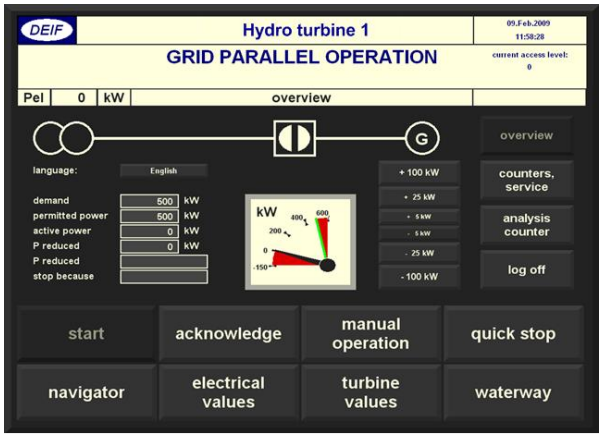
If several users are online at the same time, they see the same graphical layout, each one on his own computer. The remote start can be blocked by a manual switch on the switchboard panel door for safety reasons. This way – under maintenance – the remote access allows for diagnosis and visualisation, but the start can only be performed locally.

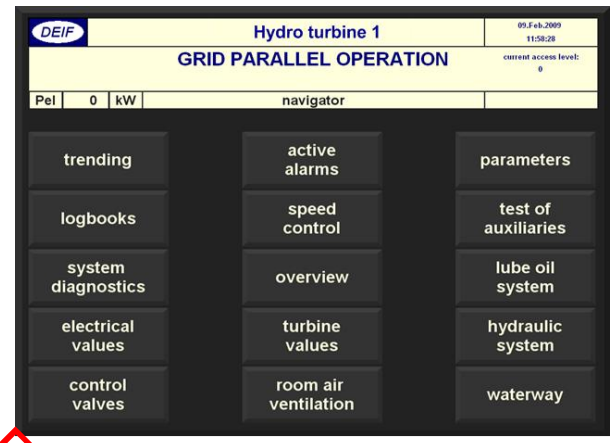
The user interface uses a browser principle with universal, plant-independent browser software. The information that has to be displayed is therefore defined on application level. Because of this principle, the data is always consistent. The PCM module is the "Server", whereas the different users are "Clients".

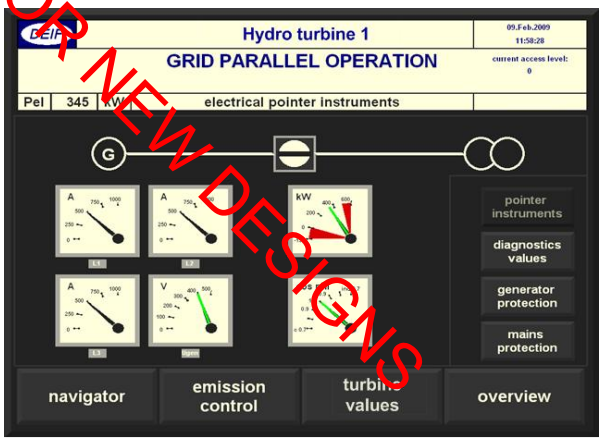
Buttons on the fully graphical user surface allow easy access to all visualisation pages. The pages are grouped by themes and can be reached fast and easy either using the menu structure or a central navigator. The status field is structured in the same way on all pages. It shows the state of the plant and – if active – the most important error message. Graphical elements like remote position indicators, bar graphs, pointer instruments for electrical values (kW, A, V, CosPhi) give a full overview of the occurrences that take place at turbine, generator, mains and plant.

The protections are visualised on special diagnostic pages together with the actual states, measurements, limits and running timers.

User interface examples







Technical Data

Rack system

Operating temp.:	-25…70°C (-13…158°F)
Vibration class:	DNV A+C 3 mm: 3.0… 13.2 Hz, 2.1 g: 13.2…50 Hz, 0.7 g: 50…100 Hz
Protection class:	IP 2x Higher class by application of standard housing for DM-4 racks
Climate:	Class E according to DIN 40040
Mounting:	Vertical
EMC/CE:	To EN 61000-6-V2/3/4, SS4631603 (PL4)
Material:	Plastic headers according to UL94-V0, Al housing, steel front plates
Connectors:	Phoenix Cage clamp terminals 6/8/20 Arms Screw terminals 20 Arms
Weight:	Depends on configuration

PCM 4.3 module

Aux. supply:	18…30V DC Max. 6 A
CAN:	3 independent CAN interfaces 125…1000 Mbps Terminals for loop through and termination
RS485:	1 interface up to 38400 Baud, terminals for loop through and termination

SCM 4.1 module

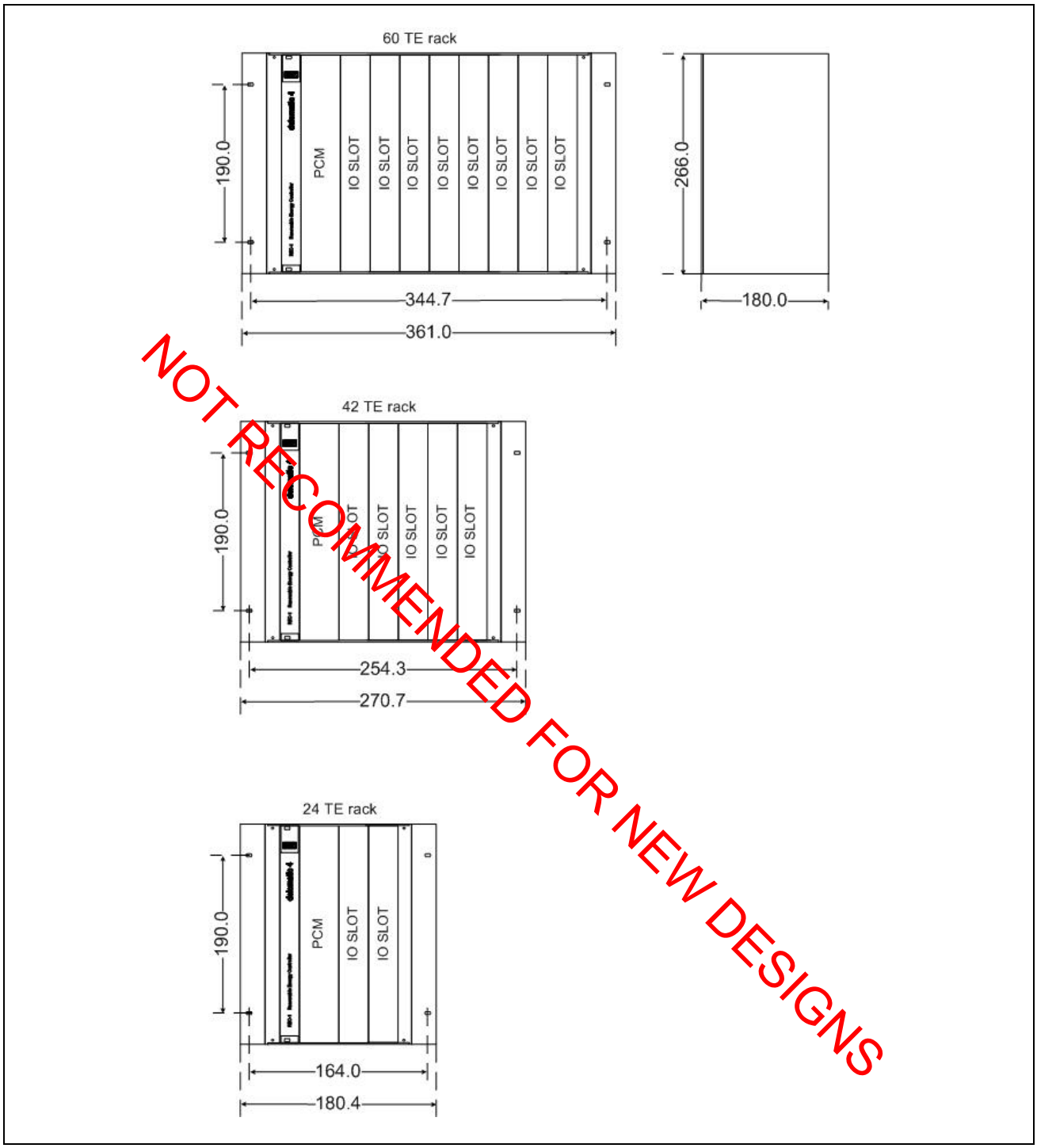
Safety:	To EN 61010-1 Overvoltage category III 690V AC Pollution degree 2
Meas. range (Un):	Up to 690 Vrms directly Other ranges after adaptation by VTs ../100 or ../110V AC Burden max 0.5 A per phase Overload max. 2*Un tolerated for 10 s External prefuse max 2 A time-lag
Meas. range (In):	Current transformer ../-1 Arms or ../-5 Arms Burden max 0.4 VA per phase Continuous overload 10 Aeff, <75 A -10 s < 300 A – 1 s
Galvanic separation:	2.5 kV isolation between voltage tips and all other potentials
Frequency:	40…70 Hz
Accuracy:	Class 0.5 according to IEC 60688
Harmonics:	Up to 500 Hz are measured

Technical Specifications

IOM 4.2:

Digital inputs:	9…36V DC, input resistance typ. 2.4 kOhm, common reference potential + or -, inputs galvanically separated from other potentials (600 V)
Frequency inputs:	Same as digital inputs, but with 2 terminals per input. Frequency max. 20 kHz pulse-pause ratio >40%. Frequency below 10 kHz, pulse-pulse ratio >20%
Accuracy:	Class 1.0
Analogue inputs:	-20 mA … +20 mA, input impedance typ. 50 Ohm, galvanically coupled to the analogue outputs, Pt100 inputs and thermocouple inputs, galvanically separated from the rest of the system (600 V rms). Accuracy: 16 bit, better than 0.5% of the full range (40 mA) over the entire temperature range.
Pt100 input:	2-, 3-, or 4-wire Pt100 or Pt1000, wire break and short-circuit detection Measurement range: -40...+200°C Accuracy: +/- 0.5 K over the full measurement range with 4-wire connection, +/- 1K with 3- or 2-wire connection, if cable length less than 1 m
Thermocouple input:	2-wire thermocouple type K (NiCr/Ni) Measurement range: 0 ...1000K more than cold junction, temperature compensation by measurement of the cold junction with a single Pt100 sensor in the whole system. Accuracy: +/- 5 K (@ 500...750°C), +/- 10 K (@ -20...500°C)
Analogue outputs:	-20 mA … +20 mA, burden up to 500 Ohm Accuracy: 10 bits, better than 0.5% of full range (40 mA) over the entire temperature range.
Digital outputs :	Output voltage 8…35V DC with external supply 9…36V DC. Output current 0..200 mA (source and sink). Short-circuit protection by current limitation. Continuously short-circuit proof up to thermal overload of the heat sinks. In case of thermal overload of the output drivers, the outputs will be disconnected and an error message will be released.

Unit measurements in mm



Errors and technical changes reserved.

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