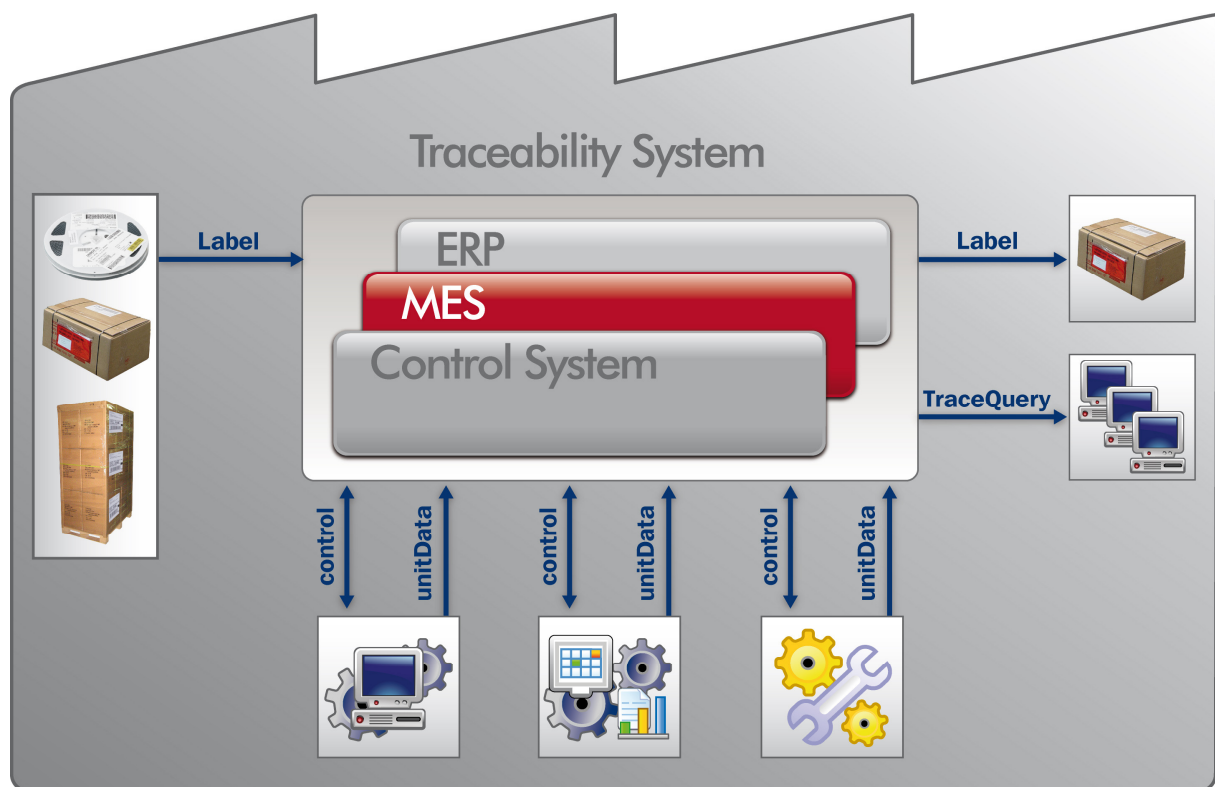


## Identification and Traceability in the Electrical and Electronics Industry



**ZVEI Interfaces to Shopfloor**  
**control, unitData**  
**substructures test, diagnosis and repair**

Version 1.1.0

## Foreword

Work on the ZVEI manual for the entire supply and value-added chain (see MIT 1 "Guideline for Identification and Traceability") has also served as a draft for an interface to Shopfloor for connecting machines, devices and workstations.

One goal of this undertaking is to standardise the interface for processes in general.

The result was the creation of two XML-based interfaces which are freely available and recommended by ZVEI for connecting to Shopfloor:

- **control** for transferring data (requests and return messages) for advanced process control while a product is being processed
- **unitData** for transferring processing data of a product

## History / changes

In MIT-2 "ZVEI-Interfaces-ChangeHistory" the history of changes of the interfaces **control** and **unitData** is described.



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# 1 Introduction

This document describes the structure of the ZVEI standard interfaces for transferring test, diagnosis and repair data.

The "test", "diagnosis" and "repair" nodes described here are used in various ZVEI standard interfaces.

For any specific use of the interface, the contents of the XML structures will have to be agreed between the parties who are to carry out the communication.

## 1.1 Symbols used

Three different symbols are used in this documentation to emphasise important content items.



### Attention!

This symbol refers to important information for which compliance is absolutely mandatory.



### Explanation!

This symbol refers to explanatory information.



### Tip!

This symbol identifies tips which provide faster or more efficient solutions.

## 1.2 Legend

[ Node/attribute ]      Square brackets: → optional node/attribute

< Node/attribute >      Pointed brackets: → alternative node/attribute



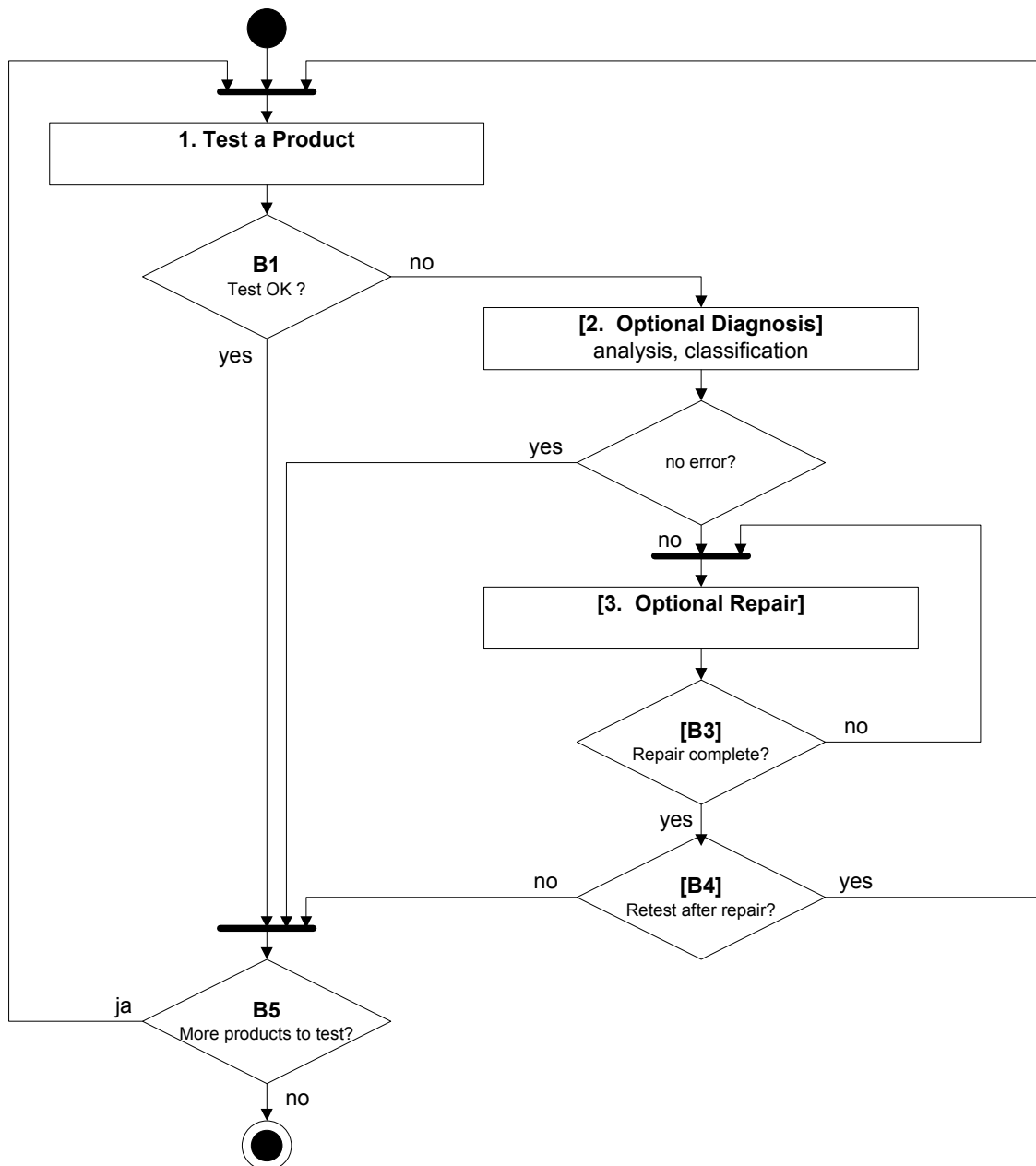
### Explanation!

If an attribute is required (not optional), the value must be assigned (no empty string).

If an attribute is not required (optional) but is present with the value = "" (empty string), the attribute will be ignored. The attribute will then be handled as if it were not even present.

## 2 Test, diagnosis (analysis, classification) and repair

The following workflow describes the general correlations between test, diagnosis (analysis, classification) and repair.



**Fig 1: Overview of workflow test, diagnosis (analysis, classification) and repair**

Test, diagnosis (analysis, classification) and repair are closely interlinked. Each process step produces a result that triggers the next action in the Test, Diagnosis and Repair loop.



### Explanation!

In practice, diagnosis (analysis, classification) and repair can also be carried out in a single process step.

### 3 XML-Schema

The XML schema is stored in an XSD file.

#### 3.1.1 test

Test data that relates to a tested product.

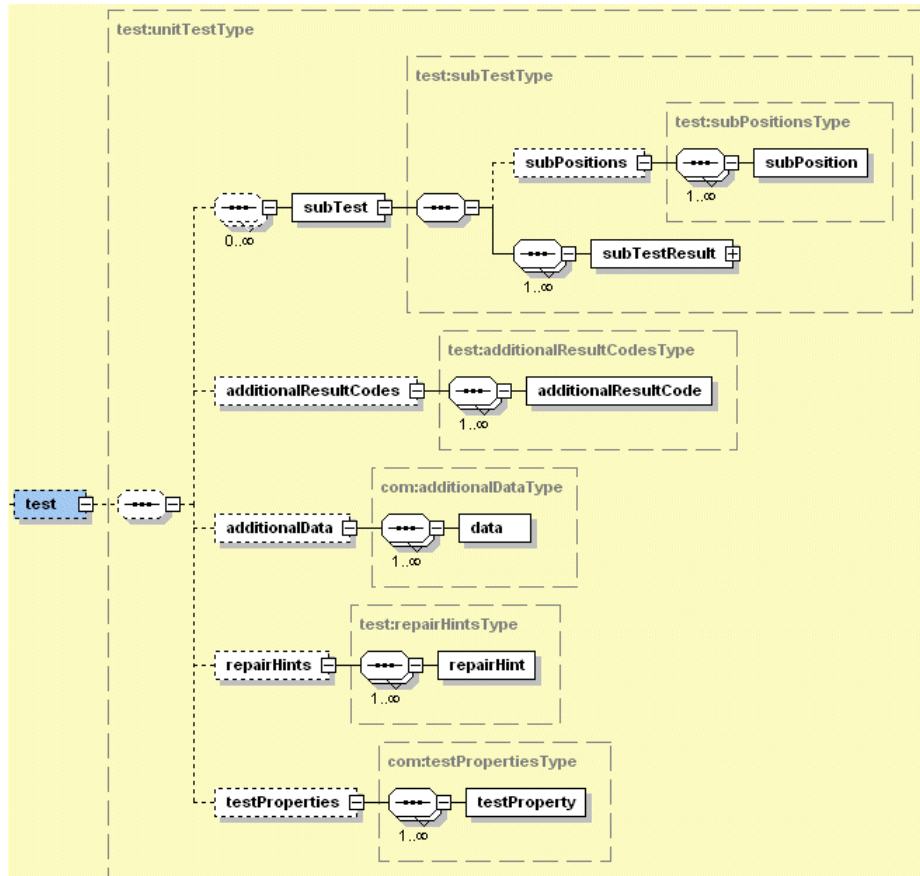


Fig 2: Schema test

### 3.1.1.1 test/subTest/subTestResult

Optional list of the subtests performed.

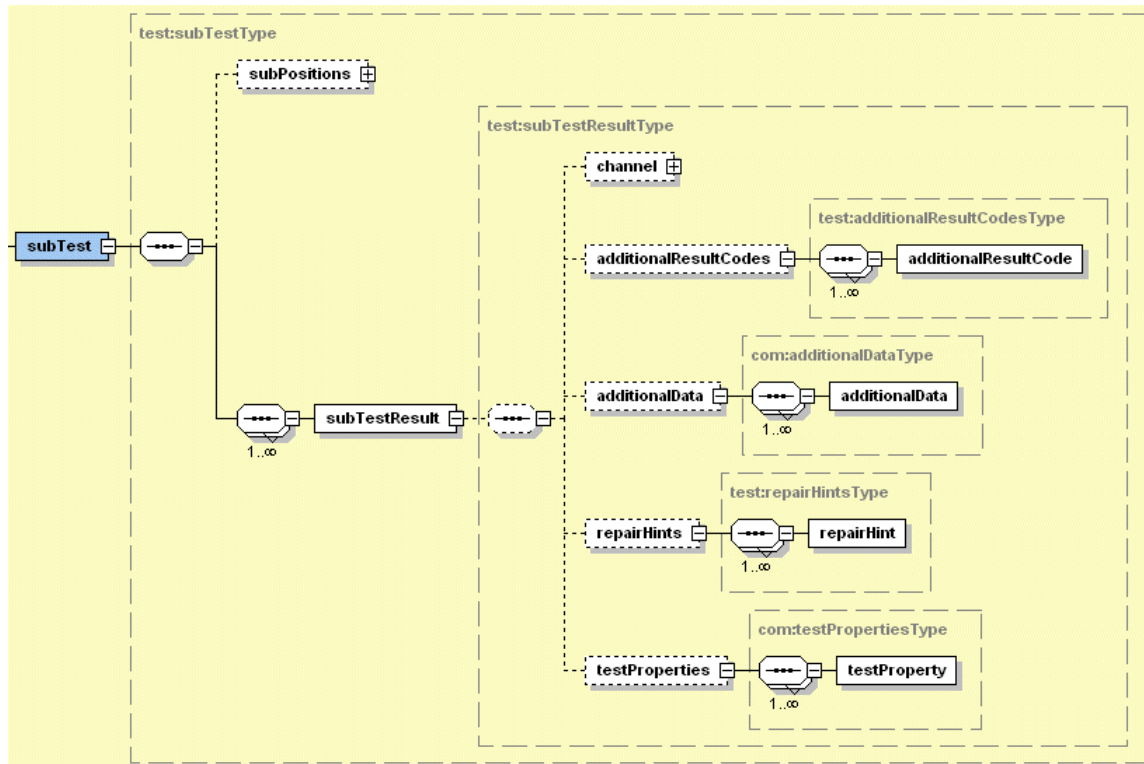


Fig 3: Schema test/subTest/subTestResult

#### 3.1.1.1.1 test/subTest/subTestResult/channel

Definition of a measuring channel.

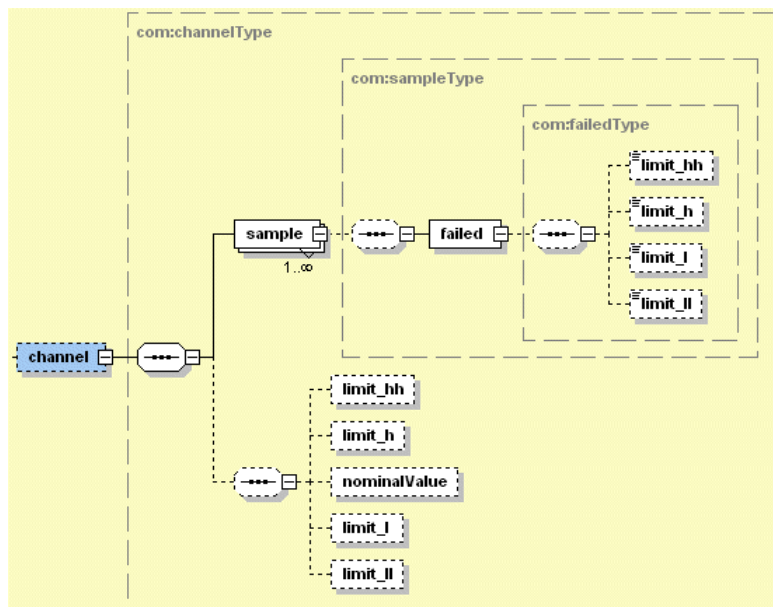


Fig 4: Schema test/subTest/subTestResult/channel

### 3.1.2 diagnosis

Data for diagnosis (analysis, classification) of test data for a test.



#### Explanation!

The structures of the nodes diagnosis and repair are practically identical. In the node repair there is a subnode subRepair/replacement where you can specify additional information about the replacement of a component.

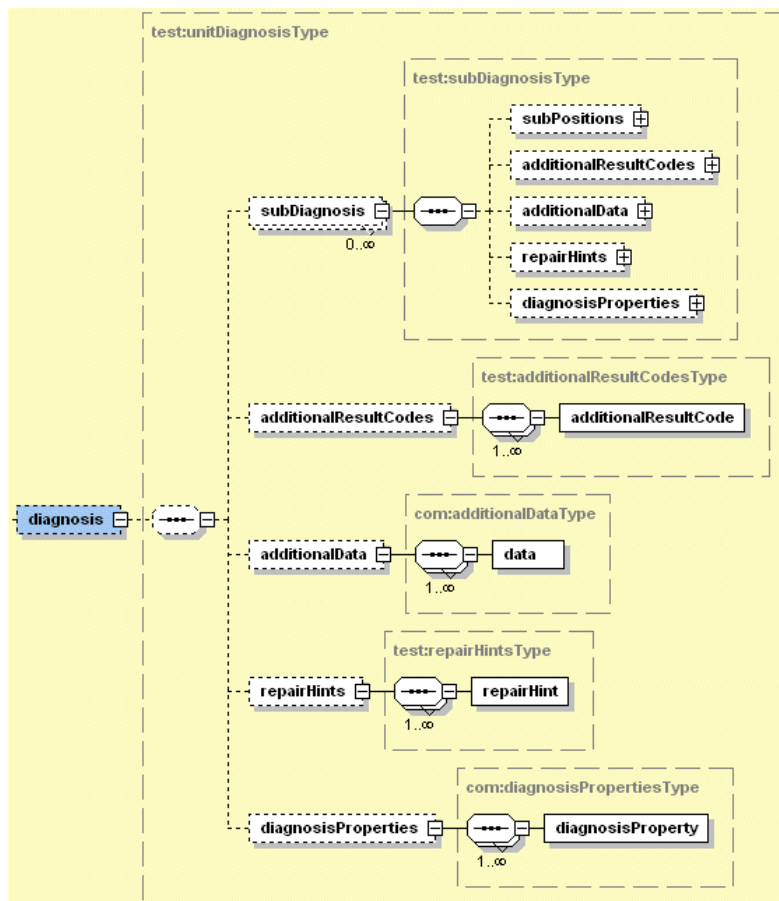


Fig 5: Schema diagnosis

### 3.1.2.1 diagnosis/subDiagnosis

Data for diagnosing (analysis, classification) test data of a subtest.

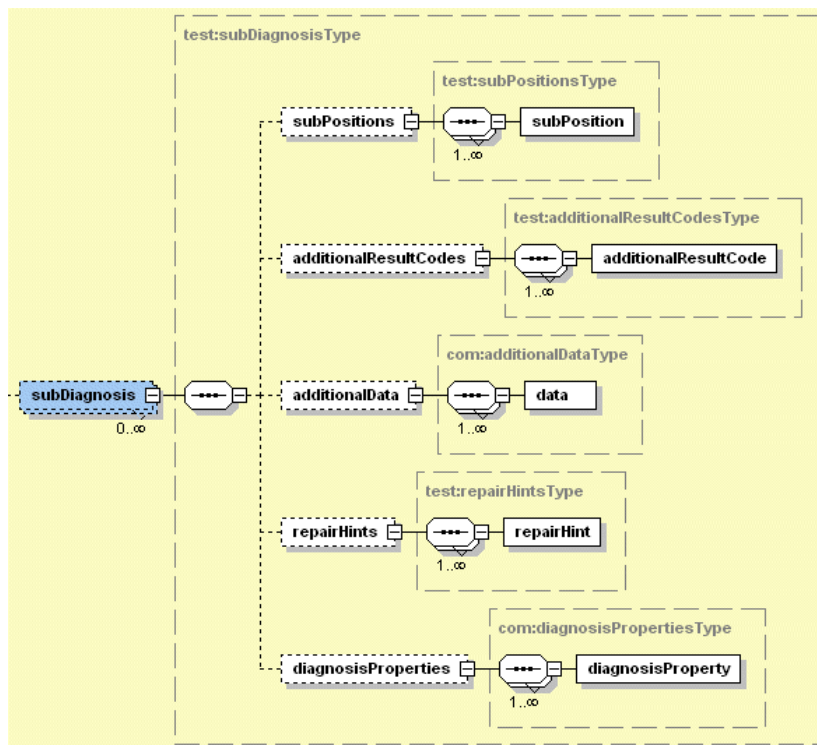


Fig 6: Schema diagnosis/subDiagnosis

### 3.1.3 repair

Data relating to a repair that has been performed on a product.



#### Explanation!

The structures of the nodes diagnosis and repair are practically identical. In the node repair there is a subnode subRepair/replacement where you can specify additional information about the replacement of a component.

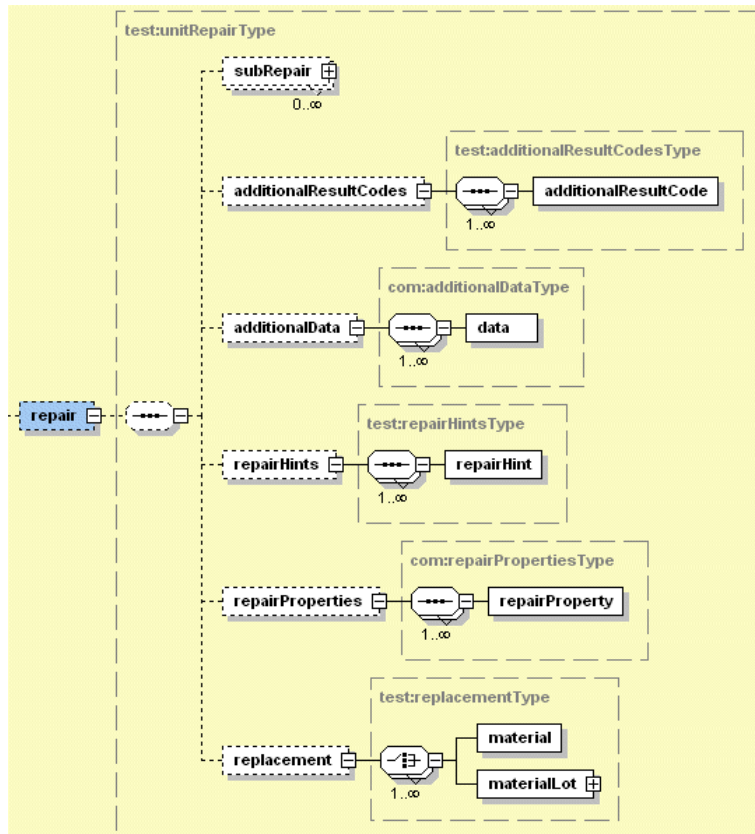


Fig 7: Schema repair

### 3.1.3.1 repair/subRepair

List of repair data.

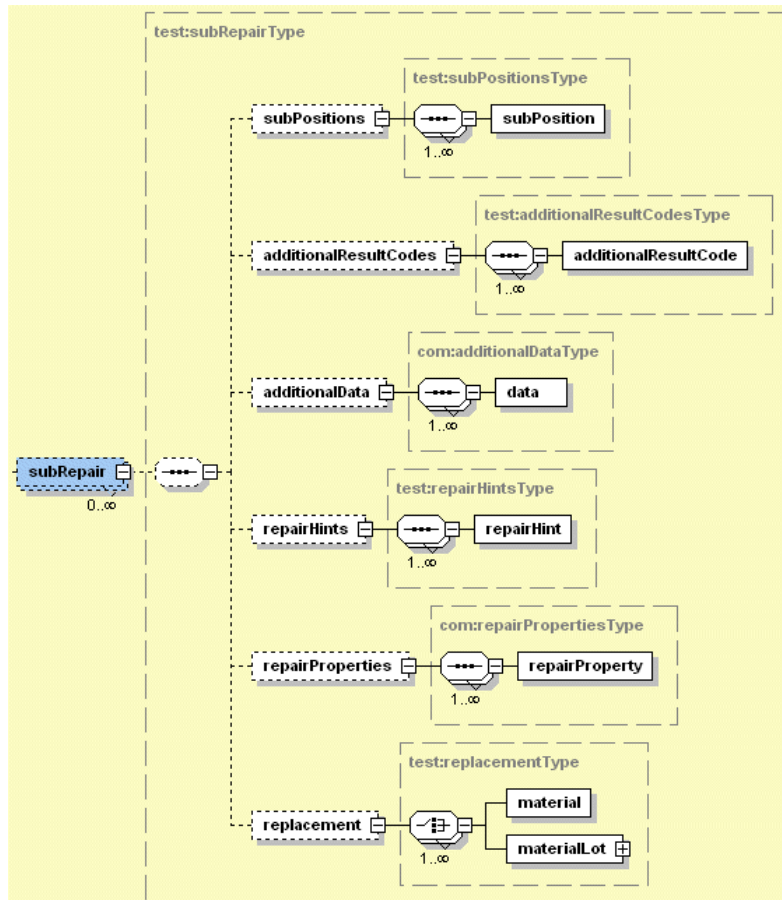


Fig 8: Schema repair/subRepair

## 4 XML-Root

The "test", "diagnosis" and "repair" nodes described here are used in various ZVEI standard interfaces.

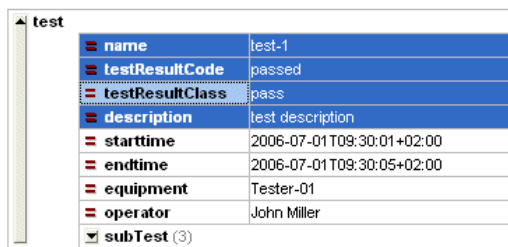
### 4.1 [test]

Test data that relates to a tested product.



#### Explanation!

Test data consists of one overall test and an arbitrary number of partial tests. A partial test has to be defined in the interface for transferring test details (e.g. the identifier of a test position).



test	
name	test-1
testResultCode	passed
testResultClass	pass
description	test description
starttime	2006-07-01T09:30:01+02:00
endtime	2006-07-01T09:30:05+02:00
equipment	Tester-01
operator	John Miller
subTest (3)	

Fig 9: node test


Attribute	Format	Description
name	String	Unique name of a test or a test procedure
testResultCode	String	 <b>Explanation:</b> The codes for the possible test results should be configurable. Some examples of standard designations include: 'passed', 'failed', 'aborted'. The specific designation must be co-ordinated with the system operator.
[testResultClass]	String	Optional attribute for classifying test results. The following classes can be specified: 'pass', 'certifiedPass', 'fail', 'interrupt', 'unknown'. When no classification is passed then the default 'unknown' applies.
[description]	String	Optional description of a test

Table 1: node test/attribute:.\*

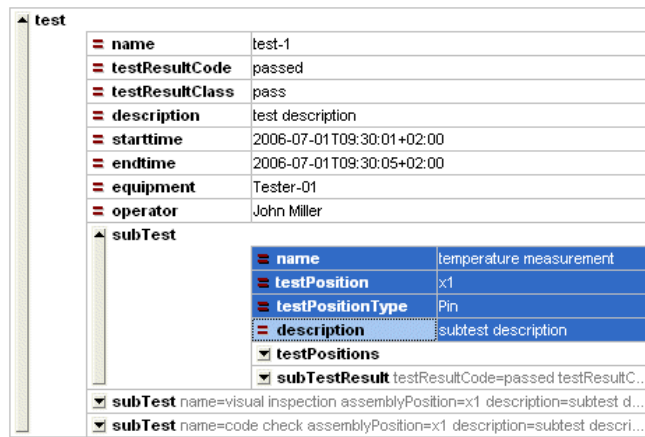
Additional attributes are only available for the forwarding of test data using control.

Attribute	Format	Description
starttime	DateTime	Time (date+time) processing of the product commenced for this process step.
[endtime]	DateTime	Time (date+time) processing of the product concluded for this process step.
equipment	String	The test was performed on this machine or this workstation.
[operator]	String	Person, who either performed the test or who adjusted the settings of the test machine.

Table 2: node test/attribute:.\* for the forwarding of test data using control

### 4.1.1 [subTest]

Optional list of performed partial tests.



test	
name	test-1
testResultCode	passed
testResultClass	pass
description	test description
starttime	2006-07-01T09:30:01+02:00
endtime	2006-07-01T09:30:05+02:00
equipment	Tester-01
operator	John Miller
subTest	
name	temperature measurement
testPosition	x1
testPositionType	Pin
description	subtest description
testPositions	
subTestResult	testResultCode=passed testResultC...
subTest	name=visual inspection assemblyPosition=x1 description=subtest d...
subTest	name=code check assemblyPosition=x1 description=subtest descri...

Fig 10: node test/subTest

Attribute	Format	Description
name	String	Unique name of a partial test.
[testPosition]	String	Test position on the tested product or position of a tested component on the product.
[testPositionType]	String	Description of the type of the tested position (e.g. Net,Component,Pin).
[description]	String	Optional description of a partial test.

Table 3: node test/subTest/attribute:.\*



#### Attention!

A partial test refers to a test position.

If different variable or attributive features are to be transferred for a test position, a separate "subTest" node is required for each feature of this test position.

#### 4.1.1.1 [subPositions]

List of test positions (e.g. pins).

##### 4.1.1.1.1 subPosition

A test position.

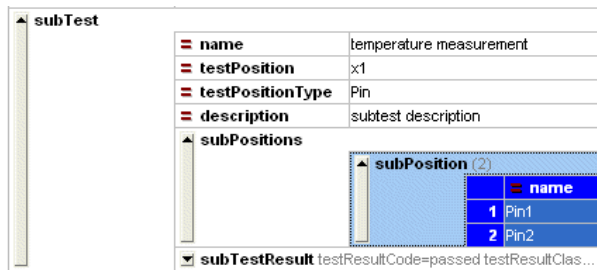


Fig 11: node test/subTest/subPositions/subPosition

Attribute	Format	Description
name	String	Name of a test position (e.g. pin).

Table 4: node test/subTest/testPositions/testPosition/attribute:.\*

#### 4.1.1.2 [subTestResult]

Result of the subtest.

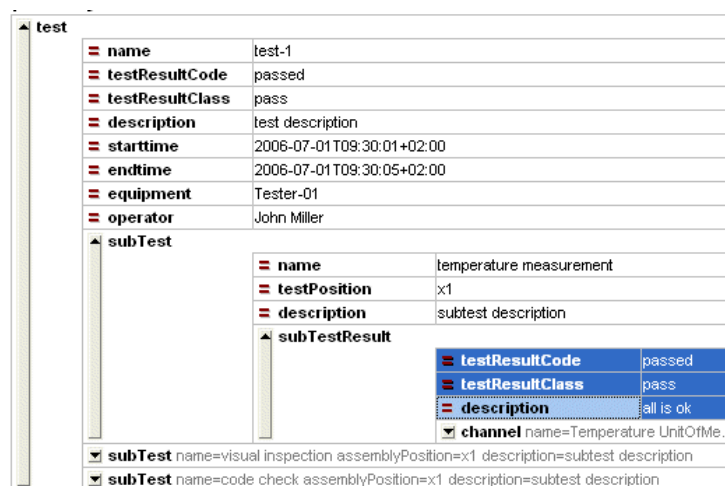


Fig 12: node test/subTest/subTestResult


Attribute	Format	Description
testResultCode	String	<b>Result of the subtest</b>  <b>Explanation:</b> The codes for the possible test results should be configurable. Some examples of standard designations include: 'passed', 'failed', 'aborted'. The specific designation must be co-ordinated with the system operator.
[testResultClass]	String	Optional attribute for classifying test results. The following classes can be specified: 'pass', 'certifiedPass', 'fail', 'interrupt', 'unknown'. When no classification is passed then the default 'unknown' applies.
[description]	String	This attribute can be used to pass texts (e.g. descriptions of faults) in addition to the test result).

Table 5: node test/subTest/subTestResult/attribute:.\*

### 4.1.1.3 channel

Definition of a measuring channel.



#### Explanation!

Normally, a measuring channel corresponds to a physical value.

subTest	
name	temperature measurement
testPosition	x1
testPositionType	Pin
description	subtest description
subPositions	
subTestResult	
testResultCode	passed
testResultClass	pass
description	all is ok
channel	
name	Temperature
UnitOfMeasure	°C
measureDataType	decimal
sample	time=2006-07-01 T09:30:05+02:00 d...
limit_hh	starttime=2006-03-31 T14:33:32+01:00 ...
limit_h	starttime=2006-03-31 T14:33:32+01:00 ...
nominalValue	starttime=2006-03-31 T14:33:32+01:00 ...
limit_l	starttime=2006-03-31 T14:33:32+01:00 ...
limit_ll	starttime=2006-03-31 T14:33:32+01:00 ...

Fig 13: node test/subTest/subTestResult/channel

Attribute	Format	Description
name	String	Name of a measuring channel
UnitOfMeasure	String	Measuring unit of a measuring channel  <b>Explanation:</b> The dimension must be entered as an SI unit of measure (see 5.4 List of relevant terms and abbreviations). In addition to SI units of measure, the following units of measure are also supported: pcs (pieces), ° (degrees), m² (square metres), l (litres), % (percent), db (decibels)
[measureDataType]	String	Optional specification of a numerical format. Possible formats: decimal, exponential, metricPrefix, hexadecimal, binary, string default: decimal (see 4.1.1.3.1 measureDataType)





Table 6: node test/subTest/subTestResult/channel/attribute::\*

#### 4.1.1.3.1 measureDataType

In some cases it makes sense for the sake of resolution or readability to display a value in a certain notation.

This can be done with the simpleType measureDataType. The attribute "measureDataType" holds the type of data and the attribute "value" holds the value. Example: measureDataType="decimal" value="3.1415".

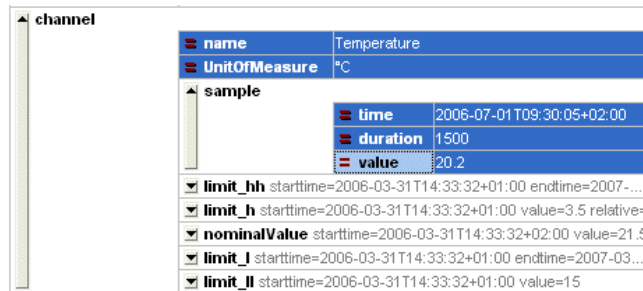
Measurement and numerical values with the attribute "measureDataType" can have the following data types: decimal, exponential, metricPrefix, hexadecimal, binary, string

measureDataType	Example	Description																																																																																								
decimal	0.031	Integer or floating point number  <b>Note:</b> In the decimal format a point is to be used as the decimal point (international notation) and not a comma as in the German spelling.																																																																																								
exponential	3.1E-2	Integer or floating point number, and directly afterwards the symbol E for exponent and the exponent itself as an integer  <b>Note:</b> A negative exponent as a minus sign. A positive exponent as a plus sign or not sign.  <b>Note</b> Between the number, and the symbol E, and the exponent no caracters (also no white spaces!) are allowed																																																																																								
metricPrefix	1μ (oder auch 31u)	Integer or floating point number, and directly afterwards the metric prefix.  <b>Hinweis</b> Between the number, and the metric prefix no characters (also no white spaces!) are allowed <table><tr><th>Prefix</th><th>Symbol</th><th>Multiplier</th><th>Exp</th></tr><tr><td>yotta</td><td>Y</td><td>1,000,000,000,000,000,000,000,000</td><td>10<sup>24</sup></td></tr><tr><td>zetta</td><td>Z</td><td>1,000,000,000,000,000,000,000,000</td><td>10<sup>21</sup></td></tr><tr><td>exa</td><td>E</td><td>1,000,000,000,000,000,000,000</td><td>10<sup>18</sup></td></tr><tr><td>peta</td><td>P</td><td>1,000,000,000,000,000,000</td><td>10<sup>15</sup></td></tr><tr><td>tera</td><td>T</td><td>1,000,000,000,000,000</td><td>10<sup>12</sup></td></tr><tr><td>giga</td><td>G</td><td>1,000,000,000</td><td>10<sup>9</sup></td></tr><tr><td>mega</td><td>M</td><td>1,000,000</td><td>10<sup>6</sup></td></tr><tr><td>kilo</td><td>k</td><td>1</td><td>10<sup>3</sup></td></tr><tr><td>hecto</td><td>h</td><td>100</td><td>10<sup>2</sup></td></tr><tr><td>deca</td><td>da</td><td>10</td><td>10<sup>1</sup></td></tr><tr><td></td><td></td><td>1</td><td>10<sup>0</sup></td></tr><tr><td>deci</td><td>d</td><td>0.1</td><td>10<sup>-1</sup></td></tr><tr><td>centi</td><td>c</td><td>0.01</td><td>10<sup>-2</sup></td></tr><tr><td>milli</td><td>m</td><td>0.001</td><td>10<sup>-3</sup></td></tr><tr><td>micro</td><td>μ (u)</td><td>0.000001</td><td>10<sup>-6</sup></td></tr><tr><td>nano</td><td>n</td><td>0.000000001</td><td>10<sup>-9</sup></td></tr><tr><td>pico</td><td>p</td><td>0.000000000001</td><td>10<sup>-12</sup></td></tr><tr><td>femto</td><td>f</td><td>0.000000000000001</td><td>10<sup>-15</sup></td></tr><tr><td>atto</td><td>a</td><td>0.000000000000000001</td><td>10<sup>-18</sup></td></tr><tr><td>zepto</td><td>z</td><td>0.000000000000000000001</td><td>10<sup>-21</sup></td></tr><tr><td>yocto</td><td>y</td><td>0.000000000000000000000001</td><td>10<sup>-24</sup></td></tr></table>	Prefix	Symbol	Multiplier	Exp	yotta	Y	1,000,000,000,000,000,000,000,000	10 <sup>24</sup>	zetta	Z	1,000,000,000,000,000,000,000,000	10 <sup>21</sup>	exa	E	1,000,000,000,000,000,000,000	10 <sup>18</sup>	peta	P	1,000,000,000,000,000,000	10 <sup>15</sup>	tera	T	1,000,000,000,000,000	10 <sup>12</sup>	giga	G	1,000,000,000	10 <sup>9</sup>	mega	M	1,000,000	10 <sup>6</sup>	kilo	k	1	10 <sup>3</sup>	hecto	h	100	10 <sup>2</sup>	deca	da	10	10 <sup>1</sup>			1	10 <sup>0</sup>	deci	d	0.1	10 <sup>-1</sup>	centi	c	0.01	10 <sup>-2</sup>	milli	m	0.001	10 <sup>-3</sup>	micro	μ (u)	0.000001	10 <sup>-6</sup>	nano	n	0.000000001	10 <sup>-9</sup>	pico	p	0.000000000001	10 <sup>-12</sup>	femto	f	0.000000000000001	10 <sup>-15</sup>	atto	a	0.000000000000000001	10 <sup>-18</sup>	zepto	z	0.000000000000000000001	10 <sup>-21</sup>	yocto	y	0.000000000000000000000001	10 <sup>-24</sup>
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hecto	h	100	10 <sup>2</sup>																																																																																							
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deci	d	0.1	10 <sup>-1</sup>																																																																																							
centi	c	0.01	10 <sup>-2</sup>																																																																																							
milli	m	0.001	10 <sup>-3</sup>																																																																																							
micro	μ (u)	0.000001	10 <sup>-6</sup>																																																																																							
nano	n	0.000000001	10 <sup>-9</sup>																																																																																							
pico	p	0.000000000001	10 <sup>-12</sup>																																																																																							
femto	f	0.000000000000001	10 <sup>-15</sup>																																																																																							
atto	a	0.000000000000000001	10 <sup>-18</sup>																																																																																							
zepto	z	0.000000000000000000001	10 <sup>-21</sup>																																																																																							
yocto	y	0.000000000000000000000001	10 <sup>-24</sup>																																																																																							
hexadecimal	1F	Integer in hexadecimal notation																																																																																								
binary	00011111	Integer in binary notation																																																																																								
string	any string	Arbitrary sequence of characters																																																																																								

**Table 7: measureDataType**

#### 4.1.1.3.2 sample

Measuring value and optional reference to violated limits.



channel	name	Temperature
	UnitOfMeasure	°C
sample	time	2006-07-01T09:30:05+02:00
	duration	1500
	value	20.2
	limit_hh	starttime=2006-03-31T14:33:32+01:00 endtime=2007-...
	limit_h	starttime=2006-03-31T14:33:32+01:00 value=3.5 relative=
	nominalValue	starttime=2006-03-31T14:33:32+02:00 value=21.5
	limit_l	starttime=2006-03-31T14:33:32+01:00 endtime=2007-03...
	limit_ll	starttime=2006-03-31T14:33:32+01:00 value=15

Fig 14: node test/subTest/subTestResult/channel/sample

Attribute	Format	Description
[time]	DateTime	Timestamp (date+time) when measuring began
[duration]	Number	Duration of measuring
value	Number	Value of measuring

Table 8: node test/subTest/subTestResult/channel/sample/attribute::\*

#### 4.1.1.3.2.1 [failed]

Properties of a failed measurement of a measuring value



##### Explanation!

There are many possible reasons for an erroneous measurement:

- A measurement error occurs
- A measurement condition was not adhered to (e.g. the measurement value exceeds a boundary value)

The measurement/measuring/channel/sample/failed node does not possess any values or attributes. It specifies a failed or erroneous measurement in a general manner.

The transgression of a boundary value as the cause of an erroneous measurement may be specified through use of the subnodes limit\_hh or limit\_ll. These nodes also possess no values or attributes.

### 4.1.1.3.3 [Nominal Value and limits]

Optional properties of nominal value and boundary values.

#### 4.1.1.3.3.1 [nominalValue]

Optional properties of nominal value

channel	
name	Temperature
UnitOfMeasure	°C
sample	time=2006-07-01T09:30:05+02:00 duration=1500 value...
limit_hh	starttime=2006-03-31T14:33:32+01:00 endtime=2007-...
limit_h	starttime=2006-03-31T14:33:32+01:00 value=3.5 relative=
nominalValue	
starttime	2006-03-31T14:33:32+02:00
value	21.5
limit_l	starttime=2006-03-31T14:33:32+01:00 endtime=2007-03...
limit_ll	starttime=2006-03-31T14:33:32+01:00 value=15

Fig 15: node test/subTest/subTestResult/channel/nominalValue

Attribute	Format	Description
value	Number	nominal value
[starttime]	DateTime	Start time for the validity of the nominal value
[endtime]	DateTime	End time for the validity of the nominal value

Table 9: node test/subTest/subTestResult/channel/nominalValue/attribute::\*

#### 4.1.1.3.3.2 [limit\_hh], [limit\_h], [limit\_l], [limit\_ll]

Optional properties of boundary values.



##### Explanation!

Optional boundary values (limit\_hh, limit\_h, limit\_l and limit\_ll) may be specified for each measurement channel

limit\_hh: higher tolerance level  
 limit\_h: higher warning level  
 limit\_l: lower warning level  
 limit\_ll: lower tolerance level

channel	
name	Temperature
UnitOfMeasure	°C
sample	time=2006-07-01T09:30:05+02:00 duration=1500 value...
limit_hh	
starttime	2006-03-31T14:33:32+01:00
endtime	2007-03-31T14:33:32+01:00
value	28
limit_h	
starttime	2006-03-31T14:33:32+01:00
value	3.5
relative	
nominalValue	starttime=2006-03-31T14:33:32+02:00 value=21.5
limit_l	starttime=2006-03-31T14:33:32+01:00 endtime=2007-03...
limit_ll	starttime=2006-03-31T14:33:32+01:00 value=15

Fig 16: node test/subTest/subTestResult/channel/limits

Attribute	Format	Description
value	Number	Boundary value for node limit_hh, limit_h, limit_l or limit_ll
[relative]		Boundary values can be specified either absolutely, without any reference, of relative to a nominal value. If the attribute 'relative' is set then the specification is relative to a nominal value.  <b>Attention:</b> A boundary value can be specified relative to a nominal value only if a nominal value is simultaneously specified in a 'nominalValue' node.
[starttime]	DateTime	Start time for the validity of the boundary value
[endtime]	DateTime	End time for the validity of the boundary value

Table 10: node test/subTest/subTestResult/channel/limits/attribute::\*

#### 4.1.1.4 [additionalResultCodes]

List of additional codes for the possible results of a subtest.

#### 4.1.1.5 [additionalData]

List of additional data for a subtest.



##### Explanation!

This additional data may be, for instance, a file or a reference to a file. Binary data must be coded base 64.

#### 4.1.1.6 [repairHints]

List of repair hints for a subtest.

#### 4.1.1.7 [testProperties]

List of additional properties for a subtest

#### 4.1.2 [additionalResultCodes]

List of additional codes for the possible results of a test.

#### 4.1.3 [additionalData]

List of additional data for a test.



**Explanation!**

This additional data may be, for instance, a file or a reference to a file. Binary data must be coded base 64.

#### 4.1.4 [repairHints]

List of repair hints for a test.

#### 4.1.5 [testProperties]

List of additional properties for a test.

## 4.2 [diagnosis]

Data for diagnosis (analysis, classification) of test data for an overall test.



### Explanation!

Transferred diagnostic data requires a reference to the test that triggered the diagnostic process.



### Explanation!

The structures of the nodes diagnosis and repair are practically identical. In the node repair there is a subnode subRepair/replacement where you can specify additional information about the replacement of a component



### Explanation!

In practice diagnosis (analysis, classification) and repair can also be carried out in a single process step..

diagnosis	
referenceTestName	test-X
referenceTestEquipment	tester-1
diagnosisResultCode	pseudoError
diagnosisResultClass	no error
description	diagnosis description
starttime	2006-07-02T08:30:01+02:00
endtime	2006-07-02T08:30:05+02:00
equipment	Repair-01
operator	John Miller
subDiagnosis	referenceSubTestName=subTest-1 diagnosisPosi...

Fig 17: node diagnosis

Attribute	Format	Description
referenceTestName	String	Name of the test whose result triggered this diagnosis.
[referenceTestEquipment]	String	Name or unique descriptor of the test machine or test station whose test results triggered this diagnosis.
diagnosisResultCode	String	<b>Result of the diagnosis (analysis, classification)</b> <b>Explanation:</b> The codes for the possible test results should be configurable. The specific designation must be co-ordinated with the system operator.
[diagnosisResultClass]	String	Optional attribute for classifying diagnostic results. The following classes can be specified: 'fault', 'pseudoFault', 'testFault', 'consecutiveFault', 'unknown'. When no classification is passed then the default 'unknown' applies.
[description]	String	Optional description or annotation for the diagnosis that has been performed.

Table 11: node diagnosis/attribute:.\*

Additional attributes are only available for the forwarding of diagnosis data using control.

Attribute	Format	Description
starttime	DateTime	Timestamp (date+time) when diagnostics for the product for this operation began.
[endtime]	DateTime	Timestamp (date+time) when diagnostics for the product for this operation ended.
equipment	String	The diagnosis was carried out on this machine or workstation
[operator]	String	Person who performed the diagnosis.

Table 12: node diagnosis/attribute:.\* for the forwarding of diagnosis data using control

### 4.2.1 [subDiagnosis]

Data for diagnosing (analysis, classification) test data for a subtest.

diagnosis	
referenceTestName	test-X
referenceTestEquipment	tester-1
diagnosisResultCode	pseudoError
diagnosisResultClass	no error
description	diagnosis description
starttime	2006-07-02T08:30:01+02:00
endtime	2006-07-02T08:30:05+02:00
equipment	Repair-01
operator	John Miller
subDiagnosis	
referenceSubTestName	subTest-1
diagnosisPosition	x0
diagnosisResultCode	pseudoError
diagnosisResultClass	no error
description	subDiagnosis description

Fig 18: node diagnosis/subDiagnosis



Attribute	Format	Description
[referenceSubTestName]	String	Name of the subtest whose result triggered the diagnosis.
[referenceSubTestPosition]	String	Reference to the position where the subtest was done.  <b>Explanation:</b> The two attributes "referenceSubTestName" and "referenceSubTestPosition" can be used to assign a subtest uniquely, even if same subtest was carried out in one test run at two different positions.
[diagnosisPosition]	String	Position of the diagnosis on the tested product or the position of an analysed component on the product.
[diagnosisPositionType]	String	Description of the type of position (e.g. Net,Component,Pin).
diagnosisResultCode	String	<b>Result of the diagnosis (analysis, classification)</b>  <b>Explanation:</b> The codes for the possible test results should be configurable. The specific designation must be co-ordinated with the system operator.
[diagnosisResultClass]	String	Optional attribute for classifying diagnostic results. The following classes can be specified: 'fault', 'pseudoFault', 'testFault', 'consecutiveFault', 'unknown'. When no classification is passed then the default 'unknown' applies.
[description]	String	Optional description or annotation for the diagnosis that has been performed.

Table 13: node diagnosis/subDiagnosis/attribute::\*

#### 4.2.1.1 [subPositions]

List of diagnosis positions (e.g. pins).

#### 4.2.1.2 [additionalResultCodes]

Additional listing for a subdiagnosis.

#### 4.2.1.3 [additionalData]

List of additional data for a subdiagnosis.



**Explanation!**

This additional data may be, for instance, a file or a reference to a file. Binary data must be coded base 64.

#### 4.2.1.4 [repairHints]

List of repair hints for a subdiagnosis.

#### 4.2.1.5 [diagnosisProperties]

List of additional properties for a subdiagnosis

### 4.3 [repair]

Data relating to a repair that has been performed on a product.



#### Explanation!

Transferred repair data requires a reference to the test that triggered the repair process.



#### Explanation!

The structures of the nodes diagnosis and repair are practically identical. In the node repair there is a subnode subRepair/replacement where you can specify additional information about the replacement of a component.



#### Explanation!

In practice, diagnosis (analysis, classification) and repair can also be carried out in a single process step.

repair	
referenceTestName	test-X
referenceTestEquipment	tester-1
repairResultCode	repaired
description	repair description
starttime	2006-07-02T08:30:01+02:00
endtime	2006-07-02T08:30:05+02:00
equipment	Repair-01
operator	John Miller
replacement	
subRepair	referenceSubTestName=subTest-1 assemblyPosition=...

Fig 19: node repair

Attribute	Format	Description
referenceTestName	String	Name of the test that triggered the repair.
[referenceTestEquipment]	String	Name or unique descriptor of the test machine or test station whose test results triggered this repair.
repairResultCode	String	<b>Result of the repair</b> <b>Explanation:</b> The codes for the possible test results should be configurable. The specific designation must be co-ordinated with the system operator.
[repairResultClass]	String	Optional attribute for classifying repair results. The following classes can be specified: 'successful', 'failed', 'interrupt', 'unknown'. When no classification is passed then the default 'unknown' applies.
[description]	String	Optional description or annotation for the repair that has been performed.

Table 14: node repair/attribute:\*

Additional attributes are only available for the forwarding of repair data using control.

Attribute	Format	Description
starttime	DateTime	The time (date+time), at which processing of the product commenced for this process step.
[endtime]	DateTime	The time (date+time), at which processing of the product concluded for this process step.
equipment	String	The test was performed on this machine or this workstation.
[operator]	String	Person who performed the repair.

Table 15: node repair/attribute:~\* for the forwarding of repair data using control

### 4.3.1 [replacement]

Data for replaced components with no reference to a specific position of the repair on the tested product.



#### Explanation!

If the replacement of a component was performed for a specific position of the repair on the tested product or for the position of a repaired component, this component will be listed in the node "repair/subRepair/replacement-/materialLot".

#### 4.3.1.1 materialLot

repair	
referenceTestName	test-X
referenceTestEquipment	tester-1
repairResultCode	repaired
description	repair description
starttime	2006-07-02T08:30:01+02:00
endtime	2006-07-02T08:30:05+02:00
equipment	Repair-01
operator	John Miller
replacement	
materialLot	
type	resistance-01
name	12345678
material	12345.12345
quantity	1
UnitOfMeasure	pcs

Fig 20: node repair/replacement/materialLot


Attribute	Format	Description
[type]	String	Type of the batch (bundle) or consumed material (component).
name	String	Unique identifier of a charge (bundle) that represents the consumed material.
[material]	String	Article number of the consumed material (component).
[quantity]	Double	Amount of material (component) consumed.
[scrapQuantity]	Double	You can use this attribute to optionally report the scrapping of components where this occurs or is found necessary while a product is being processed (defective or rejected components).
[UnitOfMeasure]	String	Unit of measure of the amount consumed  <b>Explanation:</b> The dimension must be entered as an SI unit of measure (see 5.4 List of relevant terms and abbreviations). In addition to SI units of measure, the following units of measure are also supported: pcs (pieces), ° (degrees), m <sup>2</sup> (square metres), l (litres), % (percent), db (decibels)

Table 16: node repair/replacement/materialLot/attribute::\*

### 4.3.2 [subRepair]

Listing of repair data.

▲ repair	
■ referenceTestName	test-X
■ referenceTestEquipment	tester-1
■ repairResultCode	repaired
■ description	repair description
■ starttime	2006-07-02T08:30:01+02:00
■ endtime	2006-07-02T08:30:05+02:00
■ equipment	Repair-01
■ operator	John Miller
☑ replacement	
▲ subRepair	
■ referenceSubTestName	subTest-1
■ repairPosition	x0
■ repairResultCode	ok
■ description	subRepair description
☑ replacement	

Fig 21: node repair/subRepair



Attribute	Format	Description
[referenceSubTestName]	String	Name of the subtest whose result triggered the repair.
[referenceSubTestPosition]	String	Reference to the position where the subtest was done.  <b>Explanation:</b> The two attributes "referenceSubTestName" and "referenceSubTestPosition" can be used to assign a subtest uniquely, even if same subtest was carried out in one test run at two different positions.
[repairPosition]	String	Position of the repair on the tested product or the position of a repaired component on the product.
[repairPositionType]	String	Description of the type of position (e.g. Net,Component,Pin).
repairResultCode	String	<b>Result of the repair for one repaired position.</b>  <b>Explanation:</b> The codes for the possible test results should be configurable. The specific designation must be co-ordinated with the system operator.
[repairResultClass]	String	Optional attribute for classifying repair results. The following classes can be specified: 'successful', 'failed', 'interrupt', 'unknown'. When no classification is passed then the default 'unknown' applies.
[description]	String	Optional description or annotation to the repair that has been performed.

Table 17: node repair/subRepair/attribute::\*

#### 4.3.2.1 [replacement]

Data for replaced components with reference to a specific position of the repair on the tested product.



##### **Explanation!**

If the replacement of a component was not performed for a specific position of the repair on the tested product or for the position of a repaired component, this component will be listed in the node "repair/subRepair/replacement-/materialLot".

##### 4.3.2.1.1 materialLot

The "materialLot" node corresponds in terms of format and attributes to the node 4.3.1.1 "repair/replacement-/materialLot"

#### 4.3.2.2 [subPositions]

List of repair positions (e.g. pins).

#### 4.3.2.3 [additionalResultCodes]

Additional listing for a partial repair.

#### 4.3.2.4 [additionalData]

List of additional data for a partial repair.



##### **Explanation!**

This additional data may be, for instance, a file or a reference to a file. Binary data must be coded base 64.

#### 4.3.2.5 [repairHints]

List of repair hints for a partial repair.

#### 4.3.2.6 [repairProperties]

List of additional properties for a partial repair

## 5 Appendix

### 5.1 List of relevant documents

MIT 1 "Guideline for Identification and Traceability"

MIT-2 "ZVEI-Interfaces-ChangeHistory"

LIT-3 "ZVEI-Interfaces-Overview"

MIT 4 "ZVEI interface control"

MIT 5 "ZVEI interface unitData"

MIT 6 "ZVEI interface TestAndRepair"

MIT 7 "ZVEI interface transfer protocols"

MIT 8 "control-1.1.xsd"

MIT 9 "unitData-1.1.xsd"

MIT 10 "ZVEI-common-1.1.xsd"

MIT 11 "ZVEI-testRepair-1.1.xsd"

MIT 12 "control\_Request-1.1.xml"

MIT 13 "control\_Response-1.1.xml"

MIT 14 "unitData-1.1.xml"

ZVEI manual for the entire supply and value-added chain

This document describes the history of changes to the interfaces control and unitData.

This document provides an overview of possible applications of the ZVEI control and unitData interfaces during the manufacturing of a product

This document describes the structure of the standard control interface for transferring data (requests and return messages) in process control (advanced process control) during the processing of a product.

This document describes the structure of the standard unitData interface for transferring data to process a product.

Description of the substructures of ZVEI standard interfaces for transferring test and repair data

Description of transfer protocols for transferring XML structures for ZVEI standard interfaces

XSD schema as file for ZVEI standard interface control

XSD schema as file for ZVEI standard interface unitData

XSD schema as file for general types that are used in various ZVEI standard interfaces

XSD schema as file for general types used to forward test and repair data that are used in various ZVEI standard interfaces

Sample request for the ZVEI standard control interface as a file

Sample return message for the ZVEI standard control interface as a file

Example of the ZVEI standard unitData interface as a file

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## 5.4 List of relevant terms and abbreviations

Term	Description
Product	Definition according to GPSG / ProdHG Description of a material that is produced Examples: <ul style="list-style-type: none"> <li>• Electronic flat module</li> <li>• Mechanical assembly</li> <li>• Device</li> </ul>
Parts list	Description of the type and number of components included in a product
Work sequence	Description of a work plan with the production steps necessary to manufacture a product.
Work process	Description of an individual production step (work or process step) that is required as part of the work sequence to manufacture a product. A work process does not need to be assigned yet to any specific equipment.
Equipment	Resources used to manufacture a product such as <ul style="list-style-type: none"> <li>• Production machines</li> <li>• Test machines</li> <li>• Manual workstations</li> <li>• Production lines</li> <li>• Production cells</li> <li>• Handling systems</li> <li>• Scanners and readers</li> <li>• Terminals (GUI)</li> <li>• Signal devices (traffic signals)</li> </ul>
PCB	Unfitted independent circuit
Flat module	Fitted independent circuit
Panel	A combination of independent circuits to form a board (virtual workpiece carrier); single or multiple panels depending on the number of independent circuits
Panel blank	Unprocessed single or double panel
Serial number	Unique number of a manufactured part
Component	A component (component, assembly, bulk material) is used for a product (for example mounted, fitted)
Batch	Physical combination of individual parts, for example roller, rod and tray in a smallest packaging unit.
Lot	Quantity of parts that have a barcode (batch). There are two types of lots, supplier lot and incoming goods lot. Supplier lots can be subdivided into smaller incoming goods lots.
MaterialLot (lot number or batch number)	The unique number of a lot or batch. The number of a supplier lot is already assigned by the supplier at delivery. The numbers of incoming goods lots can be (re)assigned in incoming goods. If incoming goods lots are combined in a smallest packaging unit it is equivalent to a batch.
SI unit	Abbreviation for: "Système International d'Unités" SI units are part of the International System of Units for Natural Sciences. This is the standard system as defined by law in most countries. It describes seven fundamental SI units: <ul style="list-style-type: none"> <li>• Length: Metre (m)</li> <li>• Weight: Kilogram (kg)</li> <li>• Time: Second (s)</li> <li>• Current strength: Ampere (A)</li> <li>• Temperature: Kelvin (K)</li> <li>• Amount of substance: Mole (mol)</li> <li>• Light intensity: Candela (cd)</li> </ul> Numerous other units are derived from these basic units, for example Newton, Pascal or Joule.