

TIM for Energy

Web Service REST API 3.2

Technical documentation



Revision Sheet

Release No.	Date	Revision Description
Rev 1	2019-04-26	Tangent Works REST Web Service technical documentation

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1. Overview

Tangent Information Modeler (TIM) is very mature and powerful forecasting/anomaly detection engine for the wide variety of different industries.

Produces “best of class” forecasting/anomaly detection results with automatic built-in model optimizer and effective data mining features. Model building is driven by an information criteria that optimizes directly generalization rather than model fit to the data, and thus, the constructed models have an excellent generalization ability.

TIM supports a wide range of forecasting/anomaly detection scenarios for energy and manufacturing industry, comes fully automatic and requires no mathematical know-how. Hence it can be easily used by a typical business user with basic domain knowledge.

This documentation describes how to use Tangent Works TIM Web Service to obtain model building result (model) and do the consequent prediction/anomaly detection using existing model.

2. Web Service Location

Tangent Works Web Service REST API is located at:

<https://tim-ws.tangent.works/v3.2/v2/api-docs>

This specification describes all available methods and object definitions.

3. Web Service Interaction and Clients Generation

3.1. Direct TIM Web Service interaction

UI version of REST API which allows to visualize and interact with the API's resources without having any of the implementation logic in place can be found at:

<https://tim-ws.tangent.works/v3.2/swagger-ui.html>

3.2. Clients Generation

Based on the client-side technology, different base client implementations can be generated in the following way:

1. Copy whole content of <https://tim-ws.tangent.works/v3.2/v2/api-docs> specification.
2. Open <http://editor.swagger.io> location.
3. Click “File/Paste Json” and paste content from step 1.

Click “Generate Client” and pick the client based on technology you use (Java, JavaScript, PHP, C#...)

3.3. Sample requests

Fully functional sample requests bodies can be found in “*attachments_rest*” zip file (should be delivered with this documentation). They can be used directly in interactive version of API on: <https://tim-works.tangent.works/v3.2/swagger-ui.html>

4. Authentication

4.1. User accounts

To call any of the available web services a valid user account need to be used. User account is provided by the technical contact at Tangent Works.

4.2. Authentication method

Tangent works web service API support Basic HTTP Authentication.

- Configure your client to use Basic authentication containing the applicable username and password.
- Client will be notified of authentication problems upon calling any method.

5. Web Service Architecture and Methods Overview

TIM Web Service architecture from “upper” level can be seen on the following picture. Important feature of this architecture is scalability. Highest computational complexity lies on the shoulders of TIM Engine units. In the case where higher computational demands are needed, additional TIM Engine “workers” can be started or are automatically started through “Azure Container Instances” service.

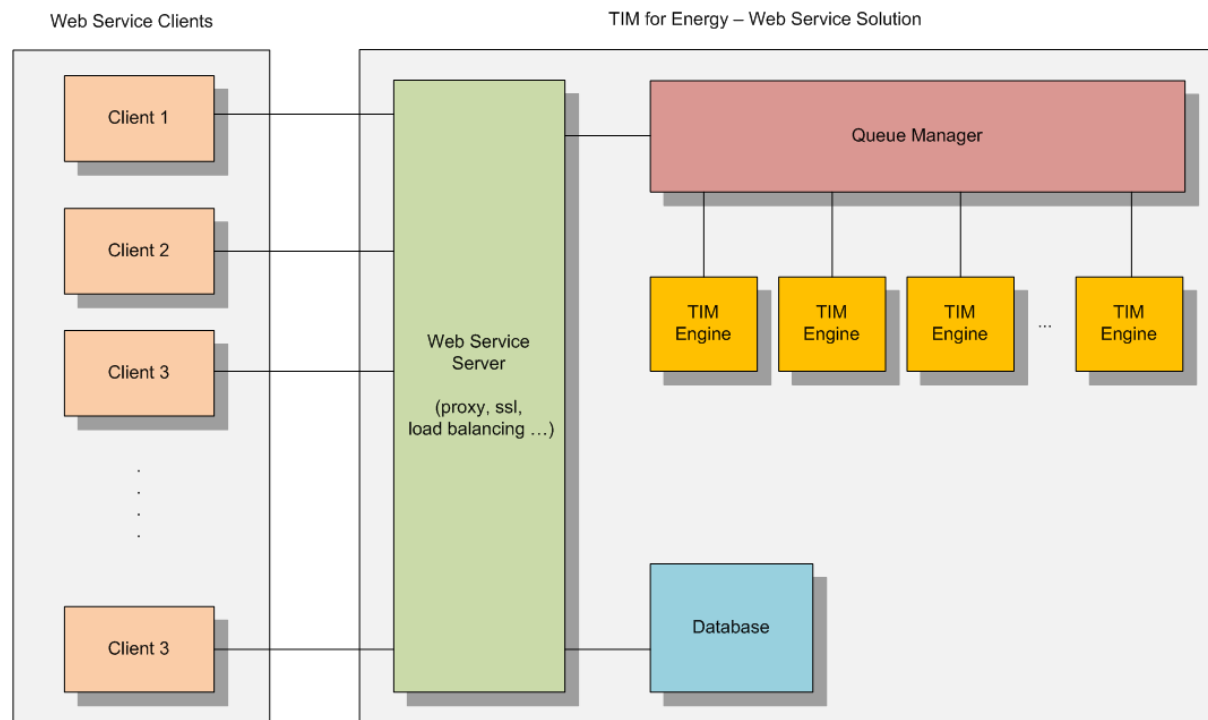


Figure 1: TIM Web Service architecture

Usual method flow is to obtain model building result (*model*) from TIM Web Service and then use it to predict data or do the anomaly detection. All methods are asynchronous methods, which are initiated with “/api/prediction/build-model” (section 8.1.1),

“/api/prediction/predict” (section 8.1.3),

“/api/prediction/build-model-predict” (section 8.1.5),

“/api/detection/build-model” (section 8.2.1),

“/api/detection/rebuild-model” (section 8.2.3) or

“/api/detection/detect” (section 8.2.5) requests.

Status and result of these methods can be retrieved with

“/api/prediction/build-model/{uuid}” (section 8.1.2),

“/api/prediction/predict/{uuid}” (section 8.1.4),

“/api/prediction/build-model-predict/{uuid}” (section 8.1.6),

"/api/detection/build-model/{uuid}" (section 8.2.2),

"/api/detection/rebuild-model/{uuid}" (section 8.2.4) or

"/api/detection/detect/{uuid}" (section 8.2.6) requests. These status request methods are typically called on regular basis where the "status" property (in "TIMModelBuildingStatusResponse", "TIMPredictionStatusResponse", "TIMModelBuildingPredictionStatusResponse", "TIMDetectModelBuildingStatusResponse", "TIMDetectModelRebuildingStatusResponse" and "TIMDetectDetectionStatusResponse" objects) informs about the current job state. When the current model building/prediction/anomaly detection job successfully finishes, the "status" property will have "Finished" value.

The usual flow i.e. for prediction process can be seen on the following picture below:

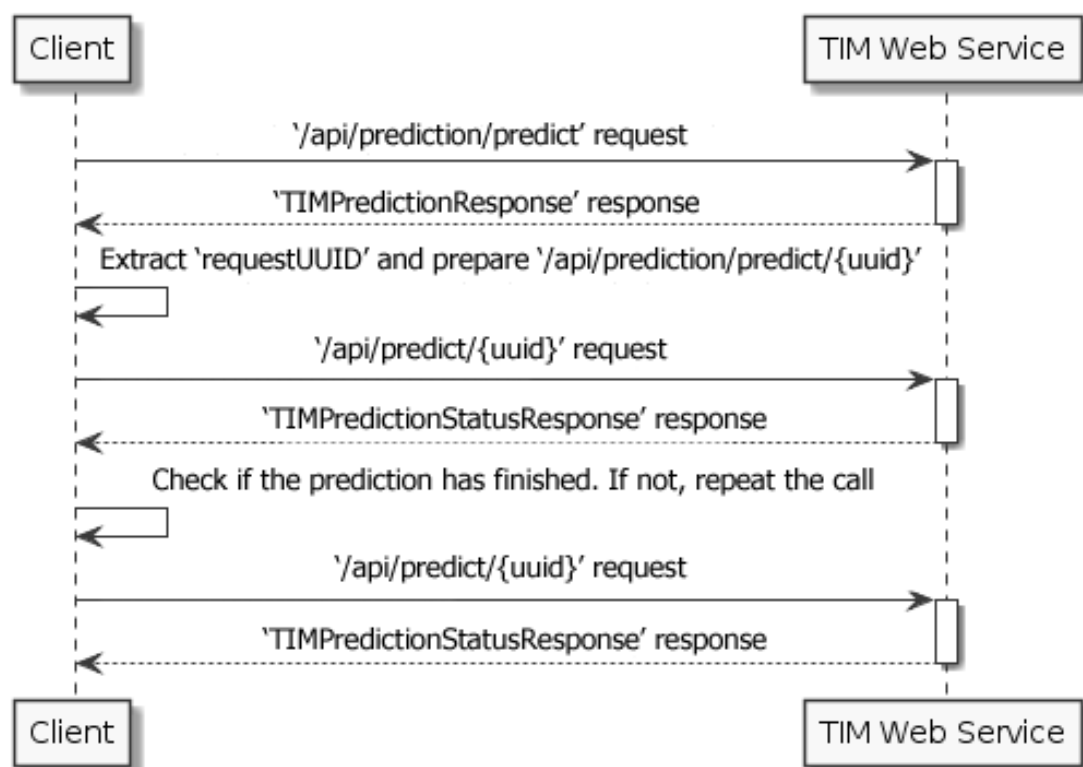


Figure 2: Prediction method flow

6. General Information

- Date-time objects in request/responses are represented with standard json "date-time" objects, which conform ISO 8601 specification:
 - <http://json-schema.org/latest/json-schema-validation.html#rfc.section.7.3.1>
 - <https://tools.ietf.org/html/rfc3339#section-5.6>

Example:

- 2010-10-01T00:00:00Z

Important Note:

- All provided “*date-time*” stamps shall be in UTC format.
- NaN and Infinity (INF) values are not supported by TIM Web Service.

7. Experiment Fundamentals and Sample Scenarios

7.1. Prediction Experiment

In this chapter we will go through simple “Electricity Load” scenario with explanation of basic experiment fundamentals (see section 8.1.1 for details).

Model building and prediction data for this experiment can be found in “*attachments_rest*” zip file in “PREDICTION_Samples” directory (should be delivered with this documentation). Fully functional model building and prediction requests can be found in the same directory as well. They can be used directly in interactive version of API on: <https://tim-ws.tangent.works/v3.2/swagger-ui.html>

Model building request

1. Every day at 8:30 and 12:30 we would like to forecast electricity consumption for the rest of the day (intra-day) and the whole next day.
2. The real consumption values update every day at 08:00 and 12:00 up until these exact times. We have historical values from "2012-01-01T00:00:00Z" to "2012-07-06T23:00:00Z" sampled hourly.
3. We want to make the prediction better using temperature values. For these we have actual values from "2012-01-01T00:00:00Z" to "2012-07-06T23:00:00Z" sampled hourly. Every day at 06:00 new data are added to the database up until the end of the previous day (closest midnight). These are all still actual values.
4. We also want to use irradiation values. For these we have actual values from "2012-01-01T00:00:00Z" to "2012-07-06T23:00:00Z" sampled hourly. Every day at 04:30 new data are added to the database up until the end of the following day. These are, of course, all forecasts. They are eventually replaced with real measured values, but we do not need to provide this information.
5. We want to use all the data currently available for model building.
6. We want engine to decide the most appropriate quality for the intra-day part of predictions and we are okay with the “High” setting for the day-ahead part of predictions.
7. As for mathematical settings, we would like the normalization to be turned on, use all available feature expansions, have model complexity 50 and time specific models.
8. Model building should return only simple measures of importance bound to original predictors. Extended importance should be omitted.
9. Model building should also return prediction available for every timestamp of target used (in-sample prediction). Aggregated and Raw predictions should be omitted.

Model building status request

10. Our model building request gets its unique ID.
11. We get informed that we did not want to enhance our data with any new meteorological predictors.
12. We get informed that model building has started, validation of our request was successful, and models are being created.
13. Progress of model building is continuously returned in percentages.
14. Data difficulty is returned.
15. Built model is used to predict target on the same data that were used for building. Progress is returned from 90 to 100 percent.
16. "Data offsets" are returned for each of the predictors. These numbers indicate how much data you have to send in to use this model in production.
17. Encrypted model is returned.
18. Simple importances are returned, and the process is ended with "Finished" state.
19. The model building configuration is also returned for the reference.
20. Predictions for every timestamp are returned as well.
21. Finally, the set of timestamps predicted with "low quality" models instead of proper ones are returned.

Prediction request

22. We want to use the model built for predicting every timestamp from "2012-07-07T09:00:00Z" to "2012-07-08T23:00:00Z".
23. The data has sampling rate one sample per one hour.
24. We include the model that we want to make predictions with.
25. And finally, we include data - notice that we do not include much more than we need according to data offsets.

7.2. "Unified/Simplified" Prediction Experiment

In this chapter we will go through simple "Electricity Load" scenario with explanation of basic experiment fundamentals as well. The difference is that now we will do combined model building/prediction request. This request predicts the specified prediction horizon from last available target timestamp and doesn't return model (see section 8.1.5 for details).

Model building/prediction data for this experiment can be found in "*attachments_rest*" zip file in "PREDICTION_Samples" directory (should be delivered with this documentation). Fully functional model building and prediction requests can be found in the same directory as well. They can be used directly in interactive version of API on: <https://tim-ws.tangent.works/v3.2/swagger-ui.html>

Model building/prediction request

1. We want to forecast electricity consumption for next 3 days from the last “target” (electricity consumption) timestamp. Current date-time is “2012-07-04T23:00:00Z”. So, we want to predict range from “2012-07-05T00:00:00Z” to “2012-07-07T23:00:00Z”.
2. We have real consumption historical values from "2012-01-01T00:00:00Z" to "2012-07-04T23:00:00Z" sampled hourly.
3. We want to make the prediction better using temperature values. For these we have actual values from "2012-01-01T00:00:00Z" to "2012-07-04T23:00:00Z" sampled hourly. We have temperature prediction for the whole next "2012-07-05" day as well.
4. We also want to use irradiation values. For these we have actual values from "2012-01-01T00:00:00Z" to "2012-04-06T23:00:00Z" sampled hourly. We have irradiation prediction for the next 2 days ("2012-07-05" and “2012-07-06”) as well.
5. We want to use all the data currently available for model building.
6. We want to set “UltraHigh” quality for the first two days and we are ok with “High” quality for the third day.
7. As for mathematical settings, we would like the normalization to be turned on, use all available feature expansions, have model complexity 50 and time specific models.
8. Model building should return only simple measures of importance bound to original predictors. Extended importance should be omitted.

Model building/prediction status request

9. Our model building/prediction request gets its unique ID.
10. We get informed that we did not want to enhance our data with any new meteorological predictors.
11. We get informed that model building/prediction process has started, validation of our request was successful, and models are being created.
12. Progress of model building/prediction is continuously returned in percentages.
13. Data difficulty is returned.
14. Progress is returned from 90 to 100 percent.
15. Simple importances are returned, and the process is ended with "Finished" state.
16. The model building/prediction configuration is also returned for the reference.
17. Finally, the built model is used to predict specified three days following the last “target” timestamp. These predictions are returned as well.

7.3. Anomaly Detection Experiment

Similarly as in the previous chapter we present simple anomaly detection scenario concerning detection of suspicious behavior in power generation of a wind turbine taking wind speed into account (see section 8.1.3 for details).

Model building and detection data for this experiment can be found in “*attachments_rest*” zip file in “DETECTION_Samples” directory (should be delivered with this documentation). Fully functional model building and prediction requests can be found in the same directory as well. They can be used directly in interactive version of API on: <https://tim-ws.tangent.works/v3.2/swagger-ui.html>

Model building request

1. We have historical values of wind turbine power generation from "2015-03-02T00:00:00Z" to "2015-10-02T23:50:00Z" sampled each 10 minutes.
2. The same holds for wind speed values. There is additional information saying the wind speed values are updated in database every 10 minutes with actual values.
3. We want to use all the data currently available for model building.
4. For normal behavior modelling part we want to normalize the data, use all available feature expansions, use time specific models and offsets of power generation.
5. We set the sensitivity to anomalies to 2.
6. For anomaly modelling part we want to normalize the data and use all available features.
7. Model building should return anomaly indicator, simple measures of importance as well as extended importances.

Detection request

8. We want to use the model built for anomaly detection every timestamp from "2015-10-05T00:00:00Z" to "2016-02-28T23:50:00Z".
9. The data has sampling rate one sample per 10 minutes.
10. We include the model that we want to make detections with.
11. Finally, we include power generation and wind speed data.

8. Details of Web Service Methods

8.1. PREDICTION

8.1.1. Model building request/response

Title	Model Building Request
URL	/api/prediction/build-model
Method	POST
Description	Model building request is used to start model building method of TIM Engine with model building parameters and model building data. Configuration of model building request allows to return not only model, but predicted values on the model building set as well.
Data Params	TIMModelBuildingRequest (section 9.1.1)
Example 1	<pre> { "configuration": { "domain": "Generic", "usage": { "usageType": "Repeating", "usageTime": [{"type": "Day", "value": "*"}, {"type": "Hour", "value": "8,9"}, {"type": "Minute", "value": "45"}], "predictionFrom": { "baseUnit": "Sample", "offset": 1}, "predictionTo": { "baseUnit": "Day", "offset": 1}, "modelQuality": [{"day": 0, "quality": "Automatic"}, {"day": 1, "quality": "High"}] }, "dataNormalization": true, "features": ["Polynomial", "TimeOffsets", "PiecewiseLinear", "Intercept", "PeriodicComponents", "DayOfWeek", "MovingAverage"], "maxModelComplexity": 50, "timeSpecificModels": true, "extendedOutputConfiguration": { "returnAggregatedPredictions": true, "returnRawPredictions": true } }, "data": [{ "uniqueName": "Load", "type": "Target", "updateTime": [{"type": "Day", "value": "*"}, {"type": "Hour", "value": "7,8"}, {"type": "Minute", "value": "10"}], "updateUntil": { "baseUnit": "Sample", "offset": 0}, "values": { "2009-01-01T00:00:00Z": 38.74110756, </pre>

	<pre> "2009-01-01T01:00:00Z": 38.74110756, ... } }] }</pre>
Example 2	Fully functional sample requests bodies can be found in "attachments_rest" zip file in "PREDICTION_Samples" directory.
Note	You can use fully functional examples directly in interactive version of API on: https://tim-ws.tangent.works/v3.2/swagger-ui.html

Title	Model Building Response
Status - OK	200 - OK
Description	Message defining model building response consist of uuid of submitted job. With this uuid you can make a model building status request to retrieve model building job status.
Response	TIMModelBuildingResponse (section 9.1.2)
Example	<pre>{ "requestUUID": "274f8a29-b57c-4d37-975d-28bc1c6626f7" }</pre>
Example Account Limitation	<pre>{ "requestUUID": "fc800d81-f9d9-4f2c-b5ad-f46652749135", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } }</pre>
Status - ERROR	401 - UNAUTHORIZED
Example	<pre>{ "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/prediction/build-model " }</pre>

8.1.2. Model building status request/response

Title	Model Building Status Request
URL	/api/prediction/build-model/{uuid}
Method	GET
Description	Model building status request is used to retrieve status of submitted model building job.
Parameter	Uuid
Description	Uuid of submitted model building job.
Request URL Example	https://tim-ws.tangent.works/v3.2/api/prediction/build-model/4672e915-99b8-4dbe-ade8-b1fc4e5ec73a

Title	Model Building Status Response
Status - OK	200 - OK
Description	Message defining current state of model building process.
Response	TIMModelBuildingStatusResponse (section 9.1.3)
Example	<pre>{ "requestUUID": "f0d467be-2222-4c12-84db-8fdb9419ab91", "status": "Finished", "events": [{ "dateTime": "2019-03-14T12:24:57.690Z", "eventType": "ModelBuildingStart" }, { "dateTime": "2019-03-14T12:24:58.166Z", "eventType": "LogMessage", "message": "Validation successful." }, { "dateTime": "2019-03-14T12:24:58.223Z", "eventType": "LogMessage", "message": "Creating model." }, { "dateTime": "2019-03-14T12:24:58.648Z", "eventType": "Progress", "message": "2.0" }, { "dateTime": "2019-03-14T12:24:59.439Z", "eventType": "Progress", "message": "15.1" }] }</pre>

	<pre> "dateTime": "2019-03-14T12:25:00.042Z", "eventType": "Progress", "message": "56.4" }, { "dateTime": "2019-03-14T12:25:02.348Z", "eventType": "Progress", "message": "100.0" }, { "dateTime": "2019-03-14T12:25:02.356Z", "eventType": "Finished", "message": "Successful" }], "dataOffsets": [{ "uniqueName": "Load", "from": { "baseUnit": "Sample", "offset": -23 } }], "progress": 100, "dataDifficulty": 49, "model": "uec5N1PnVCS1UKoUCU1YMN....", "engineResult": "Successful", "resultExplanations": [], } </pre>
Status - ERROR	401 - UNAUTHORIZED
Example	<pre> { "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/prediction/build-model/{uuid}" } </pre>

8.1.3. Prediction request/response

Title	Prediction Request
URL	/api/prediction/predict
Method	POST
Description	Prediction request is used to start prediction method of TIM Engine with prediction data and generated model from model building phase.
Data Params	TIMPredictionRequest (section 9.1.4)
Example 1	<pre>{ "model": "uec5NlPjVCS1WKoEs...", "data": [{ "uniqueName": "Load", "type": "Target", "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 38.74110756, ... } }] }</pre>
Example 2	Fully functional sample requests bodies can be found in "attachments_rest" zip file in "PREDICTION_Samples" directory.

Title	Prediction Response
Status - OK	200 - OK
Description	Message defining prediction response consist of uuid of submitted job. With this uuid you can make a prediction status request to retrieve prediction job status.
Response	TIMPredictionResponse (section 9.1.5)
Example	<pre>{ "requestUUID": "358f8a29-b57c-4d37-975d-28bc1c6626f7" }</pre>
Example Account Limitation	<pre>{ "requestUUID": "358f8a29-b57c-4d37-975d-28bc1c6626f7", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } }</pre>
Status - ERROR	401 - UNAUTHORIZED

Example	<pre>{ "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/prediction/predict" }</pre>
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8.1.4. Prediction status request/response

Title	Prediction Status Request
URL	/api/prediction/predict/{uuid}
Method	GET
Description	Prediction status request is used to retrieve status of submitted prediction job.
Parameter	uuid
Description	Uuid of submitted prediction job.
Request URL Example	https://tim-ws.tangent.works/v3.2/api/prediction/predict/4672e915-99b8-4dbe-ade8-b1fc4e5ec73a

Title	Prediction Status Response
Status - OK	200 - OK
Description	Message defining current state of prediction process.
Response	TIMPredictionStatusResponse (section 9.1.6)
Example	<pre>{ "status": "Finished", "requestUUID": "bacac46f-88d7-44bd-9489-6beeb47aef40", "events": [{ "dateTime": "2019-03-14T12:28:39.296Z", "eventType": "PredictionStart" }, { "dateTime": "2019-03-14T12:28:39.685Z", "eventType": "LogMessage", "message": "Validation successful." }, { "dateTime": "2019-03-14T12:28:39.685Z", "eventType": "Progress", "message": "1.0" }, { "dateTime": "2019-03-14T12:28:39.686Z",</pre>

	<pre> "eventType": "Progress", "message": "30.4" }, { "dateTime": "2019-03-14T12:28:39.686Z", "eventType": "Progress", "message": "100.0" }, { "dateTime": "2019-03-14T12:28:39.686Z", "eventType": "Finished", "message": "Successful" }], "progress": 100, "engineResult": "Successful", "resultExplanations": [], "prediction": { "values": { "2019-03-14T10:00:00.000Z": 52.5273, "2019-03-14T11:00:00.000Z": 45.3786, "2019-03-14T12:00:00.000Z": 36.4541, ... } } } } </pre>
Status - ERROR	401 - UNAUTHORIZED
Example	<pre> { "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/prediction/predict/{uuid}" } </pre>

8.1.5. Model building/prediction request/response

Title	Model Building/Prediction Request
URL	/api/prediction/build-model-predict
Method	POST
Description	Combined model building/prediction request is used to start model building and consequent prediction method of TIM Engine with input parameters and input data. This method performs direct prediction from last “target” timestamp without returning model.
Data Params	TIMModelBuildingPredictionRequest (section 9.1.7)
Example 1	<pre> { "configuration": { "domain": "Generic", "usage": { "predictionTo": { "baseUnit": "Day", "offset": 1}, "modelQuality": [</pre>

	<pre> {"day": 0, "quality": "Automatic"}, {"day": 1, "quality": "High"}] }, "dataNormalization": true, "features": ["Polynomial", "TimeOffsets", "Piecewiselinear", "Intercept", "PeriodicComponents", "DayOfWeek", "MovingAverage"], "maxModelComplexity": 50, "timeSpecificModels": true, "extendedOutputConfiguration": { "returnSimpleImportances": true } }, "data": [{ "uniqueName": "Load", "type": "Target", "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 38.74110756, ... } }] } </pre>
Example 2	Fully functional sample requests bodies can be found in “attachments_rest” zip file in “PREDICTION_Samples” directory.
Note	You can use fully functional examples directly in interactive version of API on: https://tim-ws.tangent.works/v3.2/swagger-ui.html

Title	Model Building Response
Status - OK	200 - OK
Description	Message defining combined model building/prediction response consist of uuid of submitted job. With this uuid you can make combined model building/prediction status request to retrieve model building/prediction job status.
Response	TIMModelBuildingPredictionResponse (section 9.1.8)
Example	<pre> { "requestUUID": "274f8a29-b57c-4d37-975d-28bc1c6626f7" } </pre>
Example Account Limitation	<pre> { "requestUUID": "fc800d81-f9d9-4f2c-b5ad-f46652749135", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } } </pre>

Status - ERROR	401 - UNAUTHORIZED
Example	<pre>{ "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/prediction/build-model-predict" }</pre>

8.1.6. Model building/prediction status request/response

Title	Model Building/Prediction Status Request
URL	/api/prediction/build-model-predict/{uuid}
Method	GET
Description	Combined model building/prediction status request is used to retrieve status of submitted combined model building/prediction job.
Parameter	uuid
Description	Uuid of submitted combined model building/prediction job.
Request URL Example	https://tim-ws.tangent.works/v3.2/api/prediction/build-model-predict/4672e915-99b8-4dbe-ade8-b1fc4e5ec73a

Title	Model Building/Prediction Status Response
Status - OK	200 - OK
Description	Message defining current state of combined model building/prediction process.
Response	TIMModelBuildingPredictionStatusResponse (section 9.1.9)
Example	<pre>{ "requestUUID": "f0d467be-2222-4c12-84db-8fdb9419ab91", "status": "Finished", "events": [{ "dateTime": "2019-03-14T12:24:57.690Z", "eventType": "ModelBuildingPredictionStart" }, { "dateTime": "2019-03-14T12:24:58.166Z", "eventType": "LogMessage", "message": "Validation successful." }] }</pre>



	<pre> "dateTime": "2019-03-14T12:24:58.223Z", "eventType": "LogMessage", "message": "Creating model." }, { "dateTime": "2019-03-14T12:24:58.648Z", "eventType": "Progress", "message": "2.0" }, { "dateTime": "2019-03-14T12:24:59.439Z", "eventType": "Progress", "message": "15.1" }, { "dateTime": "2019-03-14T12:25:00.042Z", "eventType": "Progress", "message": "56.4" }, { "dateTime": "2019-03-14T12:25:01.042Z", "eventType": "Prediction", "message": "Prediction" }, { "dateTime": "2019-03-14T12:25:02.348Z", "eventType": "Progress", "message": "100.0" }, { "dateTime": "2019-03-14T12:25:02.356Z", "eventType": "Finished", "message": "Successful" }], "prediction": { "values": { "2019-03-14T10:00:00.000Z": 52.5273, "2019-03-14T11:00:00.000Z": 45.3786, "2019-03-14T12:00:00.000Z": 36.4541, ... } }, "progress": 100, "dataDifficulty": 49, "engineResult": "Successful", "resultExplanations": [], } </pre>
Status - ERROR	401 - UNAUTHORIZED
Example	<pre> { "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/prediction/build-model-predict/{uuid}" } </pre>

8.2. ANOMALY DETECTION

8.2.1. Model building request/response

Title	Model Building Request
URL	/api/detection/build-model
Method	POST
Description	Model building request is used to start model building method of TIM Engine with model building parameters and model building data. Configuration of model building request allows to return not only model, but anomaly indicator values on the model building set as well.
Data Params	TIMDetectModelBuildingRequest (section 9.2.1)
Example 1	<pre>{ "configuration": { "sensitivity": 2, "normalBehaviorModellingConfiguration": { "dataNormalization": true, "features": ["Polynomial", "TimeOffsets", "PiecewiseLinear"], "timeSpecificModels": true, "useTargetOffsets": true }, "abnormalBehaviorModellingConfiguration": { "dataNormalization": true, "features": ["Residual", "Fluctuation", "FluctuationChange"] }, "extendedOutputConfiguration": { "returnAnomalyIndicator": true, "returnSimpleImportances": true, "returnExtendedImportances": true } }, "data": [{ "uniqueName": "ProducedEnergy", "type": "Target", "values": { "2009-01-01T00:00:00Z": 16.82145, "2009-01-01T01:00:00Z": 18.24467, ... } }] }</pre>



Example 2	Fully functional sample requests bodies can be found in “attachments_rest” zip file in “DETECTION_Samples” directory.
Note	You can use fully functional examples directly in interactive version of API on: https://tim-ws.tangent.works/v3.2/swagger-ui.html

Title	Model Building Response
Status - OK	200 - OK
Description	Message defining model building response consist of uuid of submitted job. With this uuid you can make a model building status request to retrieve model building job status.
Response	TIMDetectModelBuildingResponse (section 9.2.2)
Example	<pre>{ "requestUUID": "274f8a29-b57c-4d37-975d-28bc1c6626f7" }</pre>
Example Account Limitation	<pre>{ "requestUUID": "fc800d81-f9d9-4f2c-b5ad-f46652749135", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } }</pre>
Status - ERROR	401 - UNAUTHORIZED
Example	<pre>{ "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/detection/build-model " }</pre>

8.2.2. Model building status request/response

Title	Model Building Status Request
URL	/api/detection/build-model/{uuid}
Method	GET
Description	Model building status request is used to retrieve status of submitted model building job.
Parameter	Uuid

Description	Uuid of submitted model building job.
Request URL Example	https://tim-ws.tangent.works/v3.2/api/detection/build-model/4672e915-99b8-4dbe-ade8-b1fc4e5ec73a

Title	Model Building Status Response
Status - OK	200 - OK
Description	Message defining current state of model building process.
Response	TIMDetectModelBuildingStatusResponse (section 9.2.3)
Example	<pre>{ "requestUUID": "f0d467be-2222-4c12-84db-8fdb9419ab91", "status": "Finished", "events": [{ "dateTime": "2019-03-14T12:24:57.690Z", "eventType": "ModelBuildingStart" }, { "dateTime": "2019-03-14T12:24:58.166Z", "eventType": "LogMessage", "message": "Validation successful." }, { "dateTime": "2019-03-14T12:24:58.223Z", "eventType": "LogMessage", "message": "Creating model." }, { "dateTime": "2019-03-14T12:24:58.648Z", "eventType": "Progress", "message": "2.0" }, { "dateTime": "2019-03-14T12:24:59.439Z", "eventType": "Progress", "message": "15.1" }, { "dateTime": "2019-03-14T12:25:00.042Z", "eventType": "Progress", "message": "56.4" }, { "dateTime": "2019-03-14T12:25:02.348Z", "eventType": "Progress", "message": "100.0" }, { "dateTime": "2019-03-14T12:25:02.356Z", "eventType": "Finished", "message": "Successful" }] }</pre>

	<pre> "dataOffsets": [{ "uniqueName": "ProducedEnergy", "from": { "baseUnit": "Sample", "offset": -23 } }], "progress": 100, "model": "uec5NlPnVCS1UKoUCU1YMN...", "engineResult": "Successful", "resultExplanations": [], } </pre>
Status - ERROR	401 - UNAUTHORIZED
Example	<pre> { "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/detection/build-model/{uuid}" } </pre>

8.2.3. Model rebuilding request/response

Title	Model Rebuilding Request
URL	/api/detection/ rebuild-model
Method	POST
Description	Model rebuilding request is used to start rebuilding method of TIM Engine with rebuilding data and generated model from model building phase.
Data Params	TIMDetectModelRebuildingRequest (section 9.2.4)
Example 1	<pre> { "configuration": { "rebuildType": "NormalBehaviorModel" }, "model": "uec5NlPjVCS1WKoEs...", "data": [{ "uniqueName": "ProducedEnergy", "type": "Target", "values": { "2009-01-01T00:00:00Z": 15.8542, "2009-01-01T01:00:00Z": 14.7411, ... } }] } </pre>

Example 2	Fully functional sample requests bodies can be found in “attachments_rest” zip file in “DETECTION_Samples” directory.
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Title	Model Rebuilding Response
Status - OK	200 - OK
Description	Message defining model rebuilding response consist of uuid of submitted job. With this uuid you can make model rebuilding status request to retrieve model rebuilding job status.
Response	TIMDetectModelRebuildingResponse (section 9.2.5)
Example	<pre>{ "requestUUID": "358f8a29-b57c-4d37-975d-28bc1c6626f7" }</pre>
Example Account Limitation	<pre>{ "requestUUID": "358f8a29-b57c-4d37-975d-28bc1c6626f7", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } }</pre>
Status - ERROR	401 - UNAUTHORIZED
Example	<pre>{ "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/detection/rebuild-model" }</pre>

8.2.4. Model rebuilding status request/response

Title	Model Rebuilding Status Request
URL	/api/detection/rebuild-model/{uuid}
Method	GET
Description	Model rebuilding status request is used to retrieve status of submitted rebuilding job.
Parameter	Uuid



Description	Uuid of submitted rebuilding job.
Request URL Example	https://tim-ws.tangent.works/v3.2/api/detection/rebuild-model/4672e915-99b8-4dbe-ade8-b1fc4e5ec73a

Title	Model Rebuilding Status Response
Status - OK	200 - OK
Description	Message defining current state of model rebuilding process.
Response	TIMDetectModelRebuildingStatusResponse (section 9.2.6)
Example	<pre>{ "requestUUID": "f0d467be-2222-4c12-84db-8fdb9419ab91", "status": "Finished", "events": [{ "dateTime": "2019-03-14T12:24:57.690Z", "eventType": "ModelRebuildingStart" }, { "dateTime": "2019-03-14T12:24:58.166Z", "eventType": "LogMessage", "message": "Validation successful." }, { "dateTime": "2019-03-14T12:24:58.223Z", "eventType": "LogMessage", "message": "Creating model." }, { "dateTime": "2019-03-14T12:24:58.648Z", "eventType": "Progress", "message": "2.0" }, { "dateTime": "2019-03-14T12:24:59.439Z", "eventType": "Progress", "message": "15.1" }, { "dateTime": "2019-03-14T12:25:00.042Z", "eventType": "Progress", "message": "56.4" }, { "dateTime": "2019-03-14T12:25:02.348Z", "eventType": "Progress", "message": "100.0" }, { "dateTime": "2019-03-14T12:25:02.356Z", "eventType": "Finished", "message": "Successful" }] }</pre>

	<pre> }], "dataOffsets": [{ "uniqueName": "ProducedEnergy", "from": { "baseUnit": "Sample", "offset": -23 } }], "progress": 100, "model": "uec5NlPnVCS1UKoUCU1YMN....", "engineResult": "Successful", "resultExplanations": [], } </pre>
Status - ERROR	401 - UNAUTHORIZED
Example	<pre> { "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/detection/rebuild-model/{uuid}" } </pre>

8.2.5. Detection request/response

Title	Detection Request
URL	/api/detection/ detect
Method	POST
Description	Model detection request is used to start detection method of TIM Engine with detection data and generated model from model building phase.
Data Params	TIMDetectDetectionRequest (section 9.2.7)
Example 1	<pre> { "model": "uec5NlPjVCS1WKoEs...", "data": [{ "uniqueName": "ProducedEnergy", "type": "Target", "values": { "2009-01-01T00:00:00Z": 15.8542, "2009-01-01T01:00:00Z": 14.7411, ... } }] } </pre>
Example 2	Fully functional sample requests bodies can be found in “attachments_rest” zip file in

	"DETECTION_Samples" directory.
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Title	Detection Response
Status - OK	200 - OK
Description	Message defining detection response consist of uuid of submitted job. With this uuid you can make detection status request to retrieve detection job status.
Response	TIMDetectDetectionResponse (section 9.2.8)
Example	<pre>{ "requestUUID": "358f8a29-b57c-4d37-975d-28bc1c6626f7" }</pre>
Example Account Limitation	<pre>{ "requestUUID": "358f8a29-b57c-4d37-975d-28bc1c6626f7", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } }</pre>
Status - ERROR	401 - UNAUTHORIZED
Example	<pre>{ "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/detection/detect" }</pre>

8.2.6. Detection status request/response

Title	Detection Status Request
URL	/api/detection/detect/{uuid}
Method	GET
Description	Detection status request is used to retrieve status of submitted detection job.
Parameter	Uuid
Description	Uuid of submitted detection job.
Request URL	https://tim-ws.tangent.works/v3.2/api/detection/detect/4672e915-99b8-4dbe-ade8-b1fc4e5ec73a

Example	
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Title	Detection Status Response
Status - OK	200 - OK
Description	Message defining current state of detection process.
Response	TIMDetectDetectionStatusResponse (section 9.2.9)
Example	<pre>{ "status": "Finished", "requestUUID": "bacac46f-88d7-44bd-9489-6beeb47aef40", "events": [{ "dateTime": "2019-03-14T12:28:39.296Z", "eventType": "DetectionStart" }, { "dateTime": "2019-03-14T12:28:39.685Z", "eventType": "LogMessage", "message": "Validation successful." }, { "dateTime": "2019-03-14T12:28:39.685Z", "eventType": "Progress", "message": "1.0" }, { "dateTime": "2019-03-14T12:28:39.686Z", "eventType": "Progress", "message": "30.4" }, { "dateTime": "2019-03-14T12:28:39.686Z", "eventType": "Progress", "message": "100.0" }, { "dateTime": "2019-03-14T12:28:39.686Z", "eventType": "Finished", "message": "Successful" }], "progress": 100, "engineResult": "Successful", "resultExplanations": [], "anomalyIndicator": { "values": { "2019-03-14T10:00:00.000Z": 4.8763, "2019-03-14T11:00:00.000Z": 5.7623, "2019-03-14T12:00:00.000Z": 2.1238, ... } } }</pre>

Status - ERROR	401 - UNAUTHORIZED
Example	<pre>{ "timestamp": "2017-03-02T14:43:59Z", "status": 401, "error": "Unauthorized", "message": "Full authentication is required", "path": "/api/detection/detect/{uuid}" }</pre>

9. Main Requests/Responses Objects Definitions

9.1. PREDICTION

9.1.1. TIMModelBuildingRequest

Title	TIMModelBuildingRequest
Description	Model building request object.
Properties	
Name	<i>configuration</i>
Type	TIMModelBuildingConfiguration (section Error! Reference source not found.)
Description	TIM Engine model building configuration.
Example	<pre>{ "configuration": { "domain": "Generic", "usage": { "usageType": "Repeating", "usageTime": [{"type": "Day", "value": "*"}, {"type": "Hour", "value": "8,9"}, {"type": "Minute", "value": "45"}], "predictionFrom": {"baseUnit": "Sample", "offset": 1}, "predictionTo": {"baseUnit": "Day", "offset": 1}, "modelQuality": [{"day": 0, "quality": "Automatic"}, {"day": 1, "quality": "High"}] }, "dataNormalization": true, "features": ["Polynomial", "TimeOffsets", "PiecewiseLinear", "Intercept", "PeriodicComponents", "DayOfWeek", "MovingAverage"], "maxModelComplexity": 50, } }</pre>

	<pre> "timeSpecificModels": true, "extendedOutputConfiguration": { "returnAggregatedPredictions": true, "returnRawPredictions": true } }, } </pre>
Name	<i>data</i>
Type	array
Items	TIMDataItem (section 10.3.1)
Description	Model building data.
Example	<pre> { "data": [{ "uniqueName": "Load", "type": "Target", "updateTime": [{"type": "Day", "value": "*"}, {"type": "Hour", "value": "7,8"}, {"type": "Minute", "value": "10"}], "updateUntil": {"baseUnit": "Sample", "offset": 0}, "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 38.74110756, ... } }] } </pre>

9.1.2. TIMModelBuildingResponse

Title	TIMModelBuildingResponse
Description	Model building response object.
Properties	
Name	<i>requestUUID</i>
Type	string
Description	UUID of model building request, which should be used in model building status request, to retrieve current state of job with that id.
Name	<i>error</i>
Type	TIMRequestError (section 10.3.10)
Description	Error information if submit of model building request ends with

	error.
Example	<pre>{ "requestUUID": "fc800d81-f9d9-4f2c-b5ad-f46652749135", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } }</pre>

9.1.3. TIMModelBuildingStatusResponse

Title	TIMModelBuildingStatusResponse
Description	Model building status response object.
Properties	
Name	<i>requestUUID</i>
Type	string
Description	UUID of requested model building status request.
Name	<i>status</i>
Type	string
Enum	"Finished", "FinishedWithWarning", "Running", "RunningWithWarning", "Failed", "NotFound"
Description	Job status. If status of job is "Failed", please contact support (support@tangent.works).
Note	In the case that some combination of parameters is not allowed, but we can continue with some kind of configuration "restriction", "RunningWithParamsRestriction" and "FinishedWithParamsRestriction" status can occur. For further details on what kind of "restriction" happened, see "events" property.
Name	<i>engineResult</i>
Type	string

Enum	"Successful", "SuccessfulWithWarning", "Error"
Description	TIM Engine model building result. Value of this property has only informational character. The most important is "status" property value.
Name	<i>progress</i>
Type/Format	number/double
Description	Current progress of model building process.
Name	<i>dataDifficulty</i>
Type/Format	number/double
Description	A measure that indicates how easily can the time series be predicted based on how well TIM could fit it on the model building set. Ranges from 0 to 100 percent.
Name	<i>predictorsImportances</i>
Type	TIMPredictorsImportances (section 10.3.3)
Description	Provides importances for individual predictors in percentage.
Example	<pre>{ "extendedImportances": [{ "termName": "Target_Name(t - 26)", "importance": 36.2, "time": 08:00:00, "type": "TargetAndTargetTransformation" }], "simpleImportances": [{ "predictorName": "Target_name", "importance": 83.1, }] }</pre>
Note	See 10.3.4 and 10.3.5 section for detailed configuration options.
Name	<i>model</i>
Type	string
Description	Model which needs to be stored by 3 rd party to be able to do subsequent prediction after model building process.
Example	<pre>{ "model": "uec5NlPhVCS1UKoUCU1YMN...." }</pre>

Name	<i>dataOffsets</i>
Type	array
Items	TIMDataOffsetItem (section 10.3.2)
Description	This offset should be taken into account during prediction phase. Represents minimal amount of needed prediction data for each predictor in subsequent prediction process with TIM Engine.
Example	<pre>{ "uniqueName": "Target_Name", "from": { "baseUnit": "Sample", "offset": -23 } }</pre>
Name	<i>events</i>
Type	array
Items	TIMEvent (section 10.3.9)
Description	Provides information about different TIM Engine events.
Example	<pre>{ "events": [{ "dateTime": "2019-03-14T12:24:58.166Z", "eventType": "LogMessage", "message": "Validation successful." }] }</pre>
Name	<i>requestedConfiguration</i>
Type	TIMModelBuildingConfiguration (section 10.1.1)
Description	This property is only informational.
Name	<i>resultExplanations</i>
Type	array
Items	TIMResultExplanationItem (section 10.3.6)
Description	Provides result explanations for final model building status. In the case there wasn't any problem, the array will be empty.
Name	<i>prediction</i>
Type	TIMPrediction (section 10.1.16)
Description	Best prediction TIM Engine can produce on the model building set. It depends on the provided model building data and configuration. So called "backtesting".

Example	<pre>{ "prediction": { "values": { "2019-03-14T10:00:00.000Z": 52.5273, "2019-03-14T11:00:00.000Z": 45.3786, "2019-03-14T12:00:00.000Z": 36.4541, ... } } }</pre>
Note	Included in response by default: NO. It can be configured through “returnPrediction” property in “extendedOutputConfiguration” of “TIMModelBuildingConfiguration” object.
Name	<i>aggregatedPredictions</i>
Type	array
Items	TIMAggregatedPrediction (section 10.1.17)
Description	<p>“Aggregated Prediction” is a way how to combine individual predictions into one time series by 2 unique keys: specific time of prediction (i.e. 20:23:57) and predicted day value.</p> <p>Example: We predict every day at “08:00:00” and “12:00:00” from one sample ahead to the end of the following day (“intraday” + “day-ahead”). This yields 4 different aggregated predictions:</p> <p>“08:00:00” Day+0 (intraday) “08:00:00” Day+1 (day-ahead) “12:00:00” Day+0 (intraday) “12:00:00” Day+1 (day-ahead)</p>
Example	<pre>{ "aggregatedPredictions": [{ "day": 0, "predictionTime": "08:45:00", "values": { "2009-01-04T09:00:00.000Z": 37.4696, "2009-01-04T10:00:00.000Z": 41.0661, ... } }] }</pre>
Note	Included in response by default: NO. It can be configured through “returnAggregatedPredictions” property in “extendedOutputConfiguration” of “TIMModelBuildingConfiguration” object.
Name	<i>rawPredictions</i>
Type	array

Items	TIMRawPrediction (section 10.1.18)
Description	<p>“Raw Prediction” is a way how to get individual predictions for every prediction timestamp by using one unique key: specific timestamp of prediction (i.e. 2007-08-01 20:23:57).</p> <p>Example: We predict every day at “08:00:00” and “12:00:00” from one sample ahead to the end of the following day (“intraday” + “day-ahead”). This yields [2 * “number of predicted days”] different raw predictions:</p> <p>“2007-08-01 08:00:00” “2007-08-01 12:00:00” “2007-08-02 08:00:00” “2007-08-02 12:00:00” ... “2007-10-30 08:00:00” “2007-10-30 12:00:00” ...</p>
Example	<pre>{ "rawPredictions": [{ "predictionDateTime": "2009-01-03T08:45:00.000Z", "values": { "2009-01-04T07:00:00.000Z": 32.1719, "2009-01-04T08:00:00.000Z": 47.5286, ... } }, ...] }</pre>
Note	Included in response by default: NO. It can be configured through “returnRawPredictions” property in “extendedOutputConfiguration” of “TIMModelBuildingConfiguration” object.
Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	For detailed information see section 11.

9.1.4. TIMPredictionRequest

Title	TIMPredictionRequest
Description	Prediction request object.
Properties	
Name	<i>configuration [optional]</i>



Type	TIMPredictionConfiguration (section 10.1.6)
Description	TIM Engine prediction configuration.
Example	<pre>{ "configuration": { "predictionScope": { "type": "Ranges", "ranges": [{ "from": "2009-01-01T00:00:00Z", "to": "2009-08-01T00:00:00Z" }] }, "extendedOutputConfiguration": { "returnAggregatedPredictions": true, "returnRawPredictions": true } } }</pre>
Name	<i>model</i>
Type	string
Description	Model retrieved after model building process.
Example	<pre>{ "model": "uec5N1PnVCS1UKoUCU1YMN..." }</pre>
Name	<i>data</i>
Type	array
Items	TIMDataItem (section 10.3.1)
Description	Prediction data.
Example	<pre>{ "data": [{ "uniqueName": "Load", "type": "Target", "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 38.74110756, ... } }] }</pre>

9.1.5. TIMPredictionResponse

Title	TIMPredictionResponse
Description	Prediction response object.
Properties	

Name	<i>requestUUID</i>
Type	string
Description	UUID of prediction request, which should be used in prediction status request, to retrieve current state of job with that id.
Name	<i>error</i>
Type	TIMRequestError (section 10.3.10)
Description	Error information if submit of prediction request ends with error.
Example	<pre>{ "requestUUID": "fc800d81-f9d9-4f2c-b5ad-f46652749135", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } }</pre>

9.1.6. TIMPredictionStatusResponse

Title	TIMPredictionStatusResponse
Description	Prediction status response object.
Properties	
Name	<i>requestUUID</i>
Type	string
Description	UUID of requested prediction status request.
Name	<i>status</i>
Type	string
Enum	"Finished", "FinishedWithWarning", "Running", "RunningWithWarning", "Failed", "NotFound"
Description	Job status. If status of job fails, please contact support.
Name	<i>engineResult</i>
Type	string
Enum	"Successful", "SuccessfulWithWarning",

	"Error"
Description	TIM Engine prediction result. Value of this property has only informational character. The most important is "status" property value.
Name	<i>progress</i>
Type/Format	number/double
Description	Current progress of prediction process.
Name	<i>prediction</i>
Type	TIMPrediction (section 10.1.16)
Description	Best prediction TIM Engine can produce based on the existing model and input data.
Example	<pre>{ "prediction": { "values": { "2019-03-14T10:00:00.000Z": 52.5273, "2019-03-14T11:00:00.000Z": 45.3786, "2019-03-14T12:00:00.000Z": 36.4541, ... } } }</pre>
Note	Included in response by default: YES. It can be configured through "returnPrediction" property in "extendedOutputConfiguration" of "TIMPredictionConfiguration" object.
Name	<i>aggregatedPredictions</i>
Type	array
Items	TIMAggregatedPrediction (section 10.1.17)
Description	<p>"Aggregated Prediction" is a way how to combine individual predictions into one time series by 2 unique keys: specific time of prediction (i.e. 20:23:57) and predicted day value.</p> <p>Example: We predict every day at "08:00:00" and "12:00:00" from one sample ahead to the end of the following day ("intraday" + "day-ahead"). This yields 4 different aggregated predictions:</p> <p>"08:00:00" Day+0 (intraday) "08:00:00" Day+1 (day-ahead) "12:00:00" Day+0 (intraday) "12:00:00" Day+1 (day-ahead)</p>
Example	<pre>{ "aggregatedPredictions": [{</pre>

	<pre> "day": 0, "predictionTime": "08:45:00", "values": { "2009-01-04T09:00:00.000Z": 37.4696, "2009-01-04T10:00:00.000Z": 41.0661, ... } }] } </pre>
Note	<p>Included in response by default: NO.</p> <p>It can be configured through “returnAggregatedPredictions” property in “extendedOutputConfiguration” of “TIMPredictionConfiguration” object.</p>
Name	<i>rawPredictions</i>
Type	array
Items	TIMRawPrediction (section 10.1.18)
Description	<p>“Raw Prediction” is a way how to get individual predictions for every prediction timestamp by using one unique key: specific timestamp of prediction (i.e. 2007-08-01 20:23:57).</p> <p>Example: We predict every day at “08:00:00” and “12:00:00” from one sample ahead to the end of the following day (“intraday” + “day-ahead”). This yields [2 * ”number of predicted days”] different raw predictions:</p> <pre> “2007-08-01 08:00:00” “2007-08-01 12:00:00” “2007-08-02 08:00:00” “2007-08-02 12:00:00” ... “2007-10-30 08:00:00” “2007-10-30 12:00:00” ... </pre>
Example	<pre> { "rawPredictions": [{ "predictionDateTime": "2009-01-03T08:45:00.000Z", "values": { "2009-01-04T07:00:00.000Z": 32.1719, "2009-01-04T08:00:00.000Z": 47.5286, ... } }, ...] } </pre>
Note	<p>Included in response by default: NO.</p> <p>It can be configured through “returnRawPredictions” property in “extendedOutputConfiguration” of “TIMPredictionConfiguration” object.</p>

Name	<i>events</i>
Type	array
Items	TIMEvent (section 10.3.9)
Description	Provides information about different TIM Engine events.
Example	<pre>{ "events": [{ "dateTime": "2019-03-14T12:24:58.166Z", "eventType": "LogMessage", "message": "Validation successful." }] }</pre>
Name	<i>resultExplanations</i>
Type	array
Items	TIMResultExplanationItem (section 10.3.6)
Description	Provides result explanations for final prediction status. In the case there wasn't any problem, the array will be empty.
Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	For detailed information see section 11.

9.1.7. TIMModelBuildingPredictionRequest

Title	TIMModelBuildingPredictionRequest
Description	Model building/prediction request object.
Properties	
Name	<i>configuration</i>
Type	TIMModelBuildingPredictionConfiguration (section 10.1.21)
Description	TIM Engine model building/prediction configuration.
Example	<pre>{ "configuration": { "domain": "Generic", "usage": { "predictionTo": {"baseUnit": "Day", "offset": 1}, "modelQuality": [{"day": 0, "quality": "Automatic"}, </pre>

	<pre> {"day": 1, "quality": "High"}] }, "dataNormalization": true, "features": ["Polynomial", "TimeOffsets", "PiecewiseLinear", "Intercept", "PeriodicComponents", "DayOfWeek", "MovingAverage"], "maxModelComplexity": 50, "timeSpecificModels": true, "extendedOutputConfiguration": { "returnSimpleImportances": true } }, } </pre>
Name	<i>data</i>
Type	array
Items	TIMDataItem (section 10.3.1)
Description	Model building/prediction data.
Example	<pre> { "data": [{ "uniqueName": "Load", "type": "Target", "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 38.74110756, ... } }] } </pre>

9.1.8. TIMModelBuildingPredictionResponse

Title	TIMModelBuildingPredictionResponse
Description	Model building/prediction response object.
Properties	
Name	<i>requestUUID</i>
Type	string
Description	UUID of model building/prediction request, which should be used in model building/prediction status request, to retrieve current state of job with that id.
Name	<i>Error</i>
Type	TIMRequestError (section 10.3.10)

Description	Error information if submit of model building/prediction request ends with error.
Example	<pre>{ "requestUUID": "fc800d81-f9d9-4f2c-b5ad-f46652749135", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } }</pre>

9.1.9. TIMModelBuildingPredictionStatusResponse

Title	TIMModelBuildingPredictionStatusResponse
Description	Model building/prediction status response object.
Properties	
Name	<i>requestUUID</i>
Type	string
Description	UUID of requested model building/prediction status request.
Name	<i>status</i>
Type	string
Enum	"Finished", "FinishedWithWarning", "Running", "RunningWithWarning", "Failed", "NotFound"
Description	Job status. If status of job is "Failed", please contact support (support@tangent.works).
Note	In the case that some combination of parameters is not allowed, but we can continue with some kind of configuration "restriction", "RunningWithParamsRestriction" and "FinishedWithParamsRestriction" status can occur. For further details on what kind of "restriction" happened, see "events" property.
Name	<i>engineResult</i>
Type	string

Enum	"Successful", "SuccessfulWithWarning", "Error"
Description	TIM Engine model building/prediction result. Value of this property has only informational character. The most important is "status" property value.
Name	<i>progress</i>
Type/Format	number/double
Description	Current progress of model building process.
Name	<i>dataDifficulty</i>
Type/Format	number/double
Description	A measure that indicates how easily can the time series be predicted based on how well TIM could fit it on the model building set. Ranges from 0 to 100 percent.
Name	<i>predictorsImportances</i>
Type	TIMPredictorsImportances (section 10.3.3)
Description	Provides importances for individual predictors in percentage.
Example	<pre>{ "extendedImportances": [{ "termName": "Target_Name(t - 26)", "importance": 36.2, "time": 08:00:00, "type": "TargetAndTargetTransformation" }], "simpleImportances": [{ "predictorName": "Target_name", "importance": 83.1, }] }</pre>
Note	See 10.3.4 and 10.3.5 section for detailed configuration options.
Name	<i>events</i>
Type	array
Items	TIMEEvent (section 10.3.9)
Description	Provides information about different TIM Engine events.
Example	<pre>{ "events": [{</pre>

	<pre> "dateTime": "2019-03-14T12:24:58.166Z", "eventType": "LogMessage", "message": "Validation successful." },] }</pre>
Name	<i>requestedConfiguration</i>
Type	TIMModelBuildingPredictionConfiguration (section 10.1.21)
Description	This property is only informational.
Name	<i>resultExplanations</i>
Type	array
Items	TIMResultExplanationItem (section 10.3.6)
Description	Provides result explanations for final model building status. In the case there wasn't any problem, the array will be empty.
Name	<i>prediction</i>
Type	TIMPrediction (section 10.1.16)
Description	Best prediction TIM Engine can produce. It depends on the provided input data and configuration.
Example	<pre> { "prediction": { "values": { "2019-03-14T10:00:00.000Z": 52.5273, "2019-03-14T11:00:00.000Z": 45.3786, "2019-03-14T12:00:00.000Z": 36.4541, ... } } }</pre>
Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	For detailed information see section 11.

9.2. ANOMALY DETECTION

9.2.1. TIMDetectModelBuildingRequest

Title	TIMDetectModelBuildingRequest
Description	Model building request object.
Properties	
Name	<i>Configuration [optional]</i>
Type	TIMDetectModelBuildingConfiguration (section 10.2.1)
Description	TIM Engine model building configuration.
Example	<pre>{ "configuration": { "sensitivity": 2, "normalBehaviorModellingConfiguration": { "dataNormalization": true, "features": ["Polynomial", "TimeOffsets", "PiecewiseLinear"], "timeSpecificModels": true, "useTargetOffsets": true }, "abnormalBehaviorModellingConfiguration": { "dataNormalization": true, "features": ["Residual", "Fluctuation", "FluctuationChange"] }, "extendedOutputConfiguration": { "returnAnomalyIndicator": true, "returnSimpleImportances": true, "returnExtendedImportances": true } } }</pre>
Name	<i>data</i>
Type	array

Items	TIMDataItem (section 10.3.1)
Description	Model building data.
Example	<pre>{ "data": [{ "uniqueName": "ProducedEnergy", "type": "Target", "values": { "2009-01-01T00:00:00Z": 54.75347242, "2009-01-01T01:00:00Z": 55.94283428, ... } }] }</pre>

9.2.2. TIMDetectModelBuildingResponse

Title	TIMDetectModelBuildingResponse
Description	Model building response object.
Properties	
Name	<i>requestUUID</i>
Type	string
Description	UUID of model building request, which should be used in model building status request, to retrieve current state of job with that id.
Name	<i>error</i>
Type	TIMRequestError (section 10.3.10)
Description	Error information if submit of model building request ends with error.
Example	<pre>{ "requestUUID": "fc800d81-f9d9-4f2c-b5ad-f46652749135", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } }</pre>

9.2.3. TIMDetectModelBuildingStatusResponse

Title	TIMDetectModelBuildingStatusResponse
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Description	Model building status response object.
Properties	
Name	<i>requestUUID</i>
Type	string
Description	UUID of requested model building status request.
Name	<i>status</i>
Type	string
Enum	"Finished", "FinishedWithWarning", "Running", "RunningWithWarning", "Failed", "NotFound"
Description	Job status. If status of job is "Failed", please contact support (support@tangent.works).
Note	In the case that some combination of parameters is not allowed, but we can continue with some kind of configuration "restriction", "RunningWithParamsRestriction" and "FinishedWithParamsRestriction" status can occur. For further details on what kind of "restriction" happened, see "events" property.
Name	<i>engineResult</i>
Type	string
Enum	"Successful", "SuccessfulWithWarning", "Error"
Description	TIM Engine model building result. Value of this property has only informational character. The most important is "status" property value.
Name	<i>progress</i>
Type/Format	number/double
Description	Current progress of model building process.
Name	<i>predictorsImportances</i>
Type	TIMPredictorsImportances (section 10.3.3)
Description	Provides importances for individual predictors in percentage.
Example	{ "extendedImportances": [

	<pre> { "termName": "Target_Name(t - 26)", "importance": 36.2, "time": 08:00:00, "type": "TargetAndTargetTransformation" }], "simpleImportances": [{ "predictorName": "Target_name", "importance": 83.1, }] } </pre>
Note	See 10.3.4 and 10.3.5 sections for detailed configuration options.
Name	<i>model</i>
Type	string
Description	Model which needs to be stored by 3 rd party to be able to do subsequent detection after model building process.
Example	<pre> { "model": "uec5NlPnVCS1UKoUCU1YMN..." } </pre>
Name	<i>dataOffsets</i>
Type	array
Items	TIMDataOffsetItem (section 10.3.2)
Description	This offset should be taken into account during detection phase. Represents minimal amount of needed detection data for each predictor in subsequent detection process with TIM Engine.
Example	<pre> { "uniqueName": "Target_Name", "from": { "baseUnit": "Sample", "offset": -23 } } </pre>
Name	<i>events</i>
Type	array
Items	TIMEvent (section 10.3.9)
Description	Provides information about different TIM Engine events.
Example	<pre> { "events": [{ "dateTime": "2019-03-14T12:24:58.166Z", "eventType": "LogMessage", "message": "Validation successful." }] } </pre>

	<pre> },] } </pre>
Name	<i>requestedConfiguration</i>
Type	TIMDetectModelBuildingConfiguration (section 10.2.1)
Description	This property is only informational.
Name	<i>resultExplanations</i>
Type	array
Items	TIMResultExplanationItem (section 10.3.6)
Description	Provides result explanations for final model building status. In the case there wasn't any problem, the array will be empty.
Name	<i>anomalyIndicator</i>
Type	TIMDetectAnomalyIndicator (section 10.2.8)
Description	Anomaly indicator values. It depends on the provided model building data and configuration.
Example	<pre> { "anomalyIndicator": { "values": { "2019-03-14T10:00:00.000Z": 1.8273, "2019-03-14T11:00:00.000Z": 0.3786, "2019-03-14T12:00:00.000Z": 0.9541, ... } } } </pre>
Note	Included in response by default: YES. It can be configured through "returnAnomalyIndicator" property in of "extendedOutputConfiguration" object.
Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	For detailed information see section 11.

9.2.4. TIMDetectModelRebuildingRequest

Title	TIMDetectModelRebuildingRequest
Description	Detection request object.

Properties	
Name	<i>configuration [optional]</i>
Type	TIMDetectModelRebuildingConfiguration (section 10.2.5)
Description	TIM Engine model rebuilding configuration.
Example	<pre>{ "configuration": { "rebuildType": "NormalBehaviorModel" } }</pre>
Name	<i>model</i>
Type	string
Description	Model retrieved after model building process.
Example	<pre>{ "model": "uec5N1PnVCS1UKoUCU1YMN..." }</pre>
Name	<i>data</i>
Type	array
Items	TIMDataItem (section 10.3.1)
Description	Model rebuilding data.
Example	<pre>{ "data": [{ "uniqueName": "ProducedEnergy", "type": "Target", "values": { "2009-01-01T00:00:00Z": 47.74110756, "2009-01-01T01:00:00Z": 54.87332742, ... } }] }</pre>

9.2.5. TIMDetectModelRebuildingResponse

Title	TIMDetectModelRebuildingResponse
Description	Model rebuilding response object.
Properties	
Name	<i>requestUUID</i>
Type	string

Description	UUID of model rebuilding request, which should be used in model rebuilding status request, to retrieve current state of job with that id.
Name	<i>error</i>
Type	TIMRequestError (section 10.3.10)
Description	Error information if submit of model rebuilding request ends with error.
Example	<pre>{ "requestUUID": "fc800d81-f9d9-4f2c-b5ad-f46652749135", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } }</pre>

9.2.6. TIMDetectModelRebuildingStatusResponse

Title	TIMDetectModelRebuildingStatusResponse
Description	Model rebuilding status response object.
Properties	
Name	<i>requestUUID</i>
Type	string
Description	UUID of requested model building status request.
Name	<i>status</i>
Type	string
Enum	"Finished", "FinishedWithWarning", "Running", "RunningWithWarning", "Failed", "NotFound"
Description	Job status. If status of job is "Failed", please contact support (support@tangent.works).
Note	In the case that some combination of parameters is not allowed, but we can continue with some kind of configuration "restriction", "RunningWithParamsRestriction" and "FinishedWithParamsRestriction" status can occur. For further details on what kind of "restriction" happened, see "events" property.
Name	<i>engineResult</i>

Type	string
Enum	"Successful", "SuccessfulWithWarning", "Error"
Description	TIM Engine model rebuilding result. Value of this property has only informational character. The most important is "status" property value.
Name	<i>progress</i>
Type/Format	number/double
Description	Current progress of model rebuilding process.
Name	<i>predictorsImportances</i>
Type	TIMPredictorsImportances (section 10.3.3)
Description	Provides importances for individual predictors in percentage.
Example	<pre>{ "extendedImportances": [{ "termName": "Target_Name(t - 26)", "importance": 36.2, "time": 08:00:00, "type": "TargetAndTargetTransformation" }], "simpleImportances": [{ "predictorName": "Target_name", "importance": 83.1, }] }</pre>
Note	See 10.3.4 and 10.3.5 sections for detailed configuration options.
Name	<i>model</i>
Type	string
Description	Model which needs to be stored by 3'rd party to be able to do subsequent detection after model rebuilding process.
Example	<pre>{ "model": "uec5N1PnVCS1UKoUCU1YMN..." }</pre>
Name	<i>dataOffsets</i>
Type	array
Items	TIMDataOffsetItem (section 10.3.2)

Description	This offset should be taken into account during detection phase. Represents minimal amount of needed detection data for each predictor in subsequent detection process with TIM Engine.
Example	<pre>{ "uniqueName": "Target_Name", "from": { "baseUnit": "Sample", "offset": -23 } }</pre>
Name	<i>events</i>
Type	array
Items	TIMEvent (section 10.3.9)
Description	Provides information about different TIM Engine events.
Example	<pre>{ "events": [{ "dateTime": "2019-03-14T12:24:58.166Z", "eventType": "LogMessage", "message": "Validation successful." }] }</pre>
Name	<i>requestedConfiguration</i>
Type	TIMDetectModelRebuildingConfiguration (section 10.2.5)
Description	This property is only informational.
Name	<i>resultExplanations</i>
Type	array
Items	TIMResultExplanationItem (section 10.3.6)
Description	Provides result explanations for final model rebuilding status. In the case there wasn't any problem, the array will be empty.
Name	<i>anomalyIndicator</i>
Type	TIMDetectAnomalyIndicator (section 10.2.8)
Description	Anomaly indicator values. It depends on the provided model rebuilding data and configuration.
Example	<pre>{ "anomalyIndicator": { "values": { "2019-03-14T10:00:00.000Z": 1.8273, "2019-03-14T11:00:00.000Z": 0.3786, "2019-03-14T12:00:00.000Z": 0.9541, ... } } }</pre>

	<pre> } } }</pre>
Note	Included in response by default: YES. It can be configured through “returnAnomalyIndicator” property in of “extendedOutputConfiguration” of “TIMDetectModelRebuildingConfiguration” object.
Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	For detailed information see section 11.

9.2.7. TIMDetectDetectionRequest

Title	TIMDetectDetectionRequest
Description	Detection request object.
Properties	
Name	<i>configuration [optional]</i>
Type	TIMDetectDetectionConfiguration (section 10.2.7)
Description	TIM Engine detection configuration.
Name	<i>model</i>
Type	string
Description	Model retrieved after model building process.
Example	<pre> { "model": "uec5N1PnVCS1UKoUCU1YMN...." }</pre>
Name	<i>data</i>
Type	array
Items	TIMDataItem (section 10.3.1)
Description	Detection data.
Example	<pre> { "data": [{ "uniqueName": "ProducedEnergy", "type": "Target", "values": { "2009-01-01T00:00:00Z": 15.3829837,</pre>

	<pre> "2009-01-01T01:00:00Z": 14.8874274, ... } }] }</pre>
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9.2.8. TIMDetectDetectionResponse

Title	TIMDetectDetectionResponse
Description	Detection response object.
Properties	
Name	<i>requestUUID</i>
Type	string
Description	UUID of detection request, which should be used in detection status request, to retrieve current state of job with that id.
Name	<i>error</i>
Type	TIMRequestError (section 10.3.10)
Description	Error information if submit of detection request ends with error.
Example	<pre> { "requestUUID": "fc800d81-f9d9-4f2c-b5ad-f46652749135", "error": { "description": "You are allowed to have max 2 concurrent requests. Please contact support.", "status": "MaximumConcurrentRequestsExceeded" } }</pre>

9.2.9. TIMDetectDetectionStatusResponse

Title	TIMDetectDetectionStatusResponse
Description	Detection status response object.
Properties	
Name	<i>requestUUID</i>
Type	string
Description	UUID of requested detection status request.
Name	<i>status</i>
Type	string

Enum	"Finished", "FinishedWithWarning", "Running", "RunningWithWarning", "Failed", "NotFound"
Description	Job status. If status of job fails, please contact support.
Name	<i>engineResult</i>
Type	string
Enum	"Successful", "SuccessfulWithWarning", "Error"
Description	TIM Engine detection result. Value of this property has only informational character. The most important is "status" property value.
Name	<i>progress</i>
Type/Format	number/double
Description	Current progress of detection process.
Name	<i>anomalyIndicator</i>
Type	TIMDetectAnomalyIndicator (section 10.2.8)
Description	Anomaly indicator values. It depends on the provided detection data and configuration.
Example	<pre>{ "anomalyIndicator": { "values": { "2019-03-14T10:00:00.000Z": 1.8273, "2019-03-14T11:00:00.000Z": 0.3786, "2019-03-14T12:00:00.000Z": 0.9541, ... } } }</pre>
Note	Included in response by default: YES. It can be configured through "returnAnomalyIndicator" property in "extendedOutputConfiguration" of "TIMDetectDetectionConfiguration" object.
Name	<i>events</i>
Type	array
Items	TIMEvent (section 10.3.9)
Description	Provides information about different TIM Engine events.

Example	<pre> { "events": [{ "dateTime": "2019-03-14T12:24:58.166Z", "eventType": "LogMessage", "message": "Validation successful." },] } </pre>
Name	<i>resultExplanations</i>
Type	array
Items	TIMResultExplanationItem (section 10.3.6)
Description	Provides result explanations for final detection status. In the case there wasn't any problem, the array will be empty.
Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	For detailed information see section 11.

10. Additional Types/Objects Definitions

10.1. PREDICTION SPECIFIC

10.1.1. TIMModelBuildingConfiguration

Title	TIMModelBuildingConfiguration
Description	TIM Engine model building configuration.
Properties	
Name	<i>domain [optional]</i>
Type	string
Enum	"Generic", "Solar"
Description	Not in use right now.
Name	<i>usage</i>
Type	TIMModelBuildingUsageOneTime (section 10.1.2) TIMModelBuildingUsageRepeating (section 10.1.3)
Description	TIM usage object defining “when” and “what” we want to forecast in the case of nonrepeating (one-time) or repeating event.
Name	<i>dataNormalization [optional]</i>
Type	boolean
Description	When normalization on, predictors are scaled by mean and standard deviation. Switching off may help for data with structural changes. For difficult datasets with structural changes (change in mean of the target time-series) disabling normalization helps TIM Engine to settle in different working regimes faster which results in an improved accuracy.
Default Value	Auto
Note	If not provided, default value will be used.
Name	<i>maxModelComplexity [optional]</i>

Type/Format	integer/int32
Description	Determines maximal complexity of models and is given in integer percentage. Difficult datasets might require lower model complexity.
Note	If not provided, TIM Engine will determine optimal model complexity in automatic way.
Value	Specify explicit number for exact model complexity selection. Defined range: 1 – 100.
Name	<i>features [optional]</i>
Type	array
Enum Items	"MovingAverage", "DayOfWeek", "PeriodicComponents", "Intercept", "PiecewiseLinear", "TimeOffsets", "Polynomial"
Description	<ul style="list-style-type: none"> • MovingAverage - Moving Average is smoothed target variable. Smoothing factor is determined automatically. Disabling MA also helps TIM to calibrate faster in a new working regime. • DayOfWeek - TIM Engine will automatically include weekday predictor as additional predictor to model building process. • PeriodicComponents - Periodic Components are periodic functions that reflect periodic behavior of the target (i.e. daily cycles). • Intercept - Variable, which handles the mean of the target. When the signals working regime changes rapidly, it might be useful to turn it off. • PiecewiseLinear - Helps handle nonlinear dependencies between predictors and target like in the case of electricity consumption and temperature (increasing dependency during summer and decreasing dependency during winter). • TimeOffsets - Various time offsets of predictors significantly improve the accuracy as some of the predictors influence the target only after some time delay. Range of offsets searched is determined automatically for each predictor. • Polynomial - Some predictors are stronger when interacting with others. Polynomial dictionary creates all interactions between pairs of predictors.
Note	If not provided, TIM Engine will determine optimal features in automatic way.
Name	<i>timeSpecificModels [optional]</i>
Type	boolean

Description	Decides whether models should focus on respective times within the day (specific hours, quarterhours, etc.). This way the model created for noon can not be reused for midnight even if the data are available. Most of the time yields higher accuracy for long enough datasets with a clear daily pattern. Makes the training faster.
Default Value	Auto
Note	If not provided, default value will be used.
Name	<i>extendedOutputConfiguration [optional]</i>
Type	TIMModelBuildingExtendedOutputConfiguration (section 10.1.4)
Description	Allows user to configure TIM Engine output returned after the model building process.
Note	If not provided, default values for each property of TIMModelBuildingExtendedOutputConfiguration will be used. See section 10.1.4 for detailed information.
Name	<i>meteoConfiguration [optional]</i>
Type	TIMMeteoModelBuildingConfiguration (section 11.3.1)
Description	For detailed information see section 11.

10.1.2. TIMModelBuildingUsageOneTime

Title	TIMModelBuildingUsageOneTime
Description	Defines “when” and “what” we want to forecast in the case that it is a nonrepeating event.
Properties	
Name	<i>usageType</i>
Type	string
Value	"OneTime"
Description	This property is used for identification of TIMModelBuildingUsage type.
Name	<i>usageTime</i>
Type	string
Description	Specific “time” when we want to forecast with the build model.
Name	<i>predictionFrom</i>

Type	TIMRelativeTime (section 10.3.7)
Description	<p>An abstract way of denoting specific timestamps with respect to the given referential “usageTime”.</p> <p>For this property, it refers to the “first/oldest” timestamp in the set of all the possible ones.</p> <p>Example: “Day+2” refers to the “first/oldest” sample in the day that is distant 2 days from the given “usageTime”.</p>
Name	<i>predictionTo</i>
Type	TIMRelativeTime (section 10.3.7)
Description	<p>An abstract way of denoting specific timestamps with respect to the given referential “usageTime”.</p> <p>For this property, it refers to the “last/newest” timestamp in the set of all the possible ones.</p> <p>Example: “Day+2” refers to the “last/newest” sample in the day that is distant 2 days from the given “usageTime”.</p>
Name	<i>modelQuality [optional]</i>
Type	array
Items	TIMModelQuality (section 10.1.5)
Description	Tells how accurate should models for forecasts in particular day be. The higher the quality is, the longer time it usually takes to build the model and accuracy should get higher, but it is not a rule.
Note	<p>If not provided, TIM Engine will determine optimal model quality in automatic way. Automatic setting sets quality “UltraHigh” for “Day+0” and “Day+1”. The “High” quality is set for the rest of the days. If the quality is set for days, that the model is not be built for, it will be ignored.</p> <p>See section 10.1.5 for “Day+X” explanation.</p>

10.1.3. TIMModelBuildingUsageRepeating

Title	TIMModelBuildingUsageRepeating
Description	Defines “when” and “what” we want to forecast in the case that it is a repeating event.
Properties	
Name	<i>usageType</i>
Type	string
Value	"Repeating"

Description	This property is used for identification of TIMModelBuildingUsage type.
Name	<i>usageTime</i>
Type	array
Items	TIMRepeatingItem (section 10.3.8)
Description	<p>Time of the prediction. Cron-like notation used to easily enumerate all the daytime instances of some repeating process. Example:</p> <p>Day: * Hour: 5,6 Minute: 40 Second: 2-6/3</p> <p>would denote: “Every day at 05:40:02, 05:40:05, 06:40:02, and 06:40:05”.</p>
Name	<i>predictionFrom</i>
Type	TIMRelativeTime (section 10.3.7)
Description	<p>An abstract way of denoting specific timestamps with respect to the given referential “usageTime”. For this property, it refers to the “first/oldest” timestamp in the set of all the possible ones.</p> <p>Example: “Day+2” refers to the “first/oldest” sample in the day that is distant 2 days from the given “usageTime”.</p>
Name	<i>predictionTo</i>
Type	TIMRelativeTime (section 10.3.7)
Description	<p>An abstract way of denoting specific timestamps with respect to the given referential “usageTime”. For this property, it refers to the “last/newest” timestamp in the set of all the possible ones.</p> <p>Example: “Day+2” refers to the “last/newest” sample in the day that is distant 2 days from the given “usageTime”.</p>
Name	<i>modelQuality [optional]</i>
Type	array
Items	TIMModelQuality (section 10.1.5)
Description	Tells how accurate should models for forecasts in particular day be. The higher the quality is, the longer time it usually takes to build the model and accuracy should get higher, but it is not a rule.

Note	If not provided, TIM Engine will determine optimal model quality in automatic way. Automatic setting sets quality “UltraHigh” for “Day+0” and “Day+1”. The “High” quality is set for the rest of the days. If the quality is set for days, that the model is not be built for, it will be ignored. See section 10.1.5 for “Day+X” explanation.
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10.1.4. TIMModelBuildingExtendedOutputConfiguration

Title	TIMModelBuildingExtendedOutputConfiguration
Description	Extended model building configuration, which allows user to configure TIM Engine output returned after the model building process.
Properties	
Name	<i>returnPrediction [optional]</i>
Type	boolean
Description	User can specify if “prediction” values should be returned by TIM Engine. For more details see 10.1.16 section.
Default Value	False
Note	If not provided, default value will be used.
Name	<i>returnAggregatedPredictions [optional]</i>
Type	boolean
Description	User can specify if “aggregated predictions” should be returned by TIM Engine. For more details see 10.1.17 section.
Default Value	False
Note	If not provided, default value will be used.
Name	<i>returnRawPredictions [optional]</i>
Type	Boolean
Description	User can specify if “raw predictions” should be returned by TIM Engine. For more details see 10.1.18 section.
Default Value	False
Note	If not provided, default value will be used.
Name	<i>returnSimpleImportances [optional]</i>

Type	boolean
Description	User can specify if “simple importances” should be returned by TIM Engine. For more details see 10.3.4 section.
Default Value	True
Note	If not provided, default value will be used.
Name	returnExtendedImportances [optional]
Type	boolean
Description	User can specify if “extended importances” should be returned by TIM Engine. For more details see 10.3.5 section.
Default Value	False
Note	If not provided, default value will be used.
Name	predictionBoundaries [optional]
Type	TIMPredictionBoundariesExplicit (section 10.1.19) TIMPredictionBoundariesNone (section 10.1.20)
Description	User can specify what type of predicted output boundaries should be applied.
Note	If not provided, TIM Engine will set automatic boundaries for predicted output.

10.1.5. TIMModelQuality

Title	TIMModelQuality
Description	<p>Tells how accurate should models for forecasts in particular day be. The higher the quality is, the longer time it usually takes to build the model and accuracy should get higher, but it is not a rule.</p> <p>Automatic setting sets quality “UltraHigh” for “Day+0” and “Day+1”. The “High” quality is set for the rest of the days. If the quality is set for days, that the model is not be built for, it will be ignored.</p>
Properties	
Name	day
Type/Format	integer/int32
Description	0 - day zero, denotes intraday forecasts, 1 denotes one day ahead forecasts, etc.
Name	quality

Type	string
Description	1. "Automatic" - automatic choice of quality 2. "Low" - dummy quality 3. "Medium" - models without offsets of target 4. "High" - model usage with only limited amount of target offsets. 5. "UltraHigh" - models of the highest quality
Enum	"Automatic", "Low", "Medium", "High", "UltraHigh"

10.1.6. TIMPredictionConfiguration

Title	TIMPredictionConfiguration
Description	TIM Engine prediction configuration.
Properties	
Name	<i>predictionScope [optional]</i>
Type	TIMPredictionScopeRanges (section 10.1.7) TIMPredictionScopeTimestamps (section 10.1.8) TIMPredictionScopeCountFrom (section 10.1.9) TIMPredictionScopeCount (section 10.1.10) TIMPredictionScopeFrom (section 10.1.11)
Description	Allows user to specify different prediction scopes in the way that fits him best.
Note	If not provided, TIM Engine will automatically detect customer's usage (as set in the model building process) and predict appropriate timestamps.
Name	<i>usage [optional]</i>
Type	TIMPredictionUsageOneTime (section 10.1.12) TIMPredictionUsageRepeating (section 10.1.13)
Description	The purpose of this property is to provide ability to specify usage subset of model building usage specified in TIMModelBuildingConfiguration (section 10.1.1).
Note	If not provided, TIM Engine will use "usage" from model building process.
Name	<i>extendedOutputConfiguration [optional]</i>
Type	TIMPredictionExtendedOutputConfiguration (section 10.1.14)
Description	Allows user to configure TIM Engine output returned after the prediction process.
Note	If not provided, default values for each property of TIMPredictionExtendedOutputConfiguration will be used. See section

	10.1.14 for detailed information.
Name	<i>meteoConfiguration [optional]</i>
Type	TIMMeteoPredictionConfiguration (section 11.3.2)
Description	For detailed information see section 11.

10.1.7. TIMPredictionScopeRanges

Title	TIMPredictionScopeRanges
Description	Allows to specify prediction scope through “Date-Time” ranges.
Properties	
Name	<i>type</i>
Type	string
Value	"Ranges"
Description	This property is used for identification of TIMPredictionScope type.
Name	<i>ranges</i>
Type	array
Items	TIMDateRange (section 10.1.15)
Description	“Date-Time” ranges to predict.

10.1.8. TIMPredictionScopeTimestamps

Title	TIMPredictionScopeTimestamps
Description	Allows to specify prediction scope through individual timestamps.
Properties	
Name	<i>type</i>
Type	string
Value	"Timestamps"
Description	This property is used for identification of TIMPredictionScope type.
Name	<i>timestamps</i>

Type	array
Items	string/date-time
Description	Timestamps to predict.

10.1.9. TIMPredictionScopeCountFrom

Title	TIMPredictionScopeCountFrom
Description	Allows to specify prediction scope through number of samples to predict from exact timestamp.
Properties	
Name	<i>type</i>
Type	string
Value	"CountFrom"
Description	This property is used for identification of TIMPredictionScope type.
Name	<i>count</i>
Type/Format	integer/int32
Description	Number of samples to predict.
Name	<i>from</i>
Type/Format	string/date-time
Description	Timestamp specifying starting point of prediction.

10.1.10. TIMPredictionScopeCount

Title	TIMPredictionScopeCount
Description	Allows to specify prediction scope through number of samples to predict. Starting point of prediction is determined automatically by TIM Engine.
Properties	
Name	<i>type</i>
Type	string
Value	"Count"

Description	This property is used for identification of TIMPredictionScope type.
Name	<i>count</i>
Type/Format	integer/int32
Description	Number of samples to predict.

10.1.11. TIMPredictionScopeFrom

Title	TIMPredictionScopeFrom
Description	Allows to specify prediction scope from exact timestamp. Number of samples to predict is determined automatically by TIM Engine.
Properties	
Name	<i>type</i>
Type	string
Value	"From"
Description	This property is used for identification of TIMPredictionScope type.
Name	<i>from</i>
Type/Format	string/date-time
Description	Timestamp specifying starting point of prediction.

10.1.12. TIMPredictionUsageOneTime

Title	TIMPredictionUsageOneTime
Description	Defines “when” and “what” we want to forecast in the case that it is a nonrepeating event.
Properties	
Name	<i>usageType</i>
Type	string
Value	"OneTime"
Description	This property is used for identification of TIMPredictionUsage type.
Name	<i>predictionFrom</i>
Type	TIMRelativeTime (section 10.3.7)

Description	<p>An abstract way of denoting specific timestamps with respect to the given referential “usageTime” in model building process. For this property, it refers to the “first/oldest” timestamp in the set of all the possible ones.</p> <p>Example: “Day+2” refers to the “first/oldest” sample in the day that is distant 2 days from the given “usageTime”.</p>
Name	<i>predictionTo</i>
Type	TIMRelativeTime (section 10.3.7)
Description	<p>An abstract way of denoting specific timestamps with respect to the given referential “usageTime” in model building process. For this property, it refers to the “last/newest” timestamp in the set of all the possible ones.</p> <p>Example: “Day+2” refers to the “last/newest” sample in the day that is distant 2 days from the given “usageTime”.</p>

10.1.13. TIMPredictionUsageRepeating

Title	TIMPredictionUsageRepeating
Description	Defines “when” and “what” we want to forecast in the case that it is a repeating event.
Properties	
Name	<i>usageType</i>
Type	string
Value	"Repeating"
Description	This property is used for identification of TIMPredictionUsage type.
Name	<i>usageTime</i>
Type	array
Items	TIMRepeatingItem (section 10.3.8)
Description	<p>Time of the prediction. Cron-like notation used to easily enumerate all the daytime instances of some repeating process.</p> <p>Example:</p> <p>Day: *</p> <p>Hour: 5,6</p> <p>Minute: 40</p> <p>Second: 2-6/3</p> <p>would denote:</p>

	"Every day at 05:40:02, 05:40:05, 06:40:02, and 06:40:05".
Name	<i>predictionFrom</i>
Type	TIMRelativeTime (section 10.3.7)
Description	<p>An abstract way of denoting specific timestamps with respect to the given referential "usageTime". For this property, it refers to the "first/oldest" timestamp in the set of all the possible ones.</p> <p>Example: "Day+2" refers to the "first/oldest" sample in the day that is distant 2 days from the given "usageTime".</p>
Name	<i>predictionTo</i>
Type	TIMRelativeTime (section 10.3.7)
Description	<p>An abstract way of denoting specific timestamps with respect to the given referential "usageTime". For this property, it refers to the "last/newest" timestamp in the set of all the possible ones.</p> <p>Example: "Day+2" refers to the "last/newest" sample in the day that is distant 2 days from the given "usageTime".</p>

10.1.14. TIMPredictionExtendedOutputConfiguration

Title	TIMPredictionExtendedOutputConfiguration
Description	Extended prediction configuration, which allows user to configure TIM Engine output returned after the prediction process.
Properties	
Name	<i>returnPrediction [optional]</i>
Type	boolean
Description	User can specify if "prediction" values should be returned by TIM Engine. For more details see 10.1.16 section.
Default Value	True
Note	If not provided, default value will be used.
Name	<i>returnAggregatedPredictions [optional]</i>
Type	boolean
Description	User can specify if "aggregated predictions" should be returned by TIM Engine. For more details see 10.1.17 section.
Default Value	False

Note	If not provided, default value will be used.
Name	returnRawPredictions <i>[optional]</i>
Type	boolean
Description	User can specify if “raw predictions” should be returned by TIM Engine. For more details see 10.1.18 section.
Default Value	False
Note	If not provided, default value will be used.
Name	predictionBoundaries <i>[optional]</i>
Type	TIMPredictionBoundariesExplicit (section 10.1.19) TIMPredictionBoundariesNone (section 10.1.20)
Description	User can specify what type of predicted output boundaries should be applied.
Note	If not provided, TIM Engine will set automatic boundaries for predicted output.

10.1.15. TIMDateRange

Title	TIMDateRange
Description	Pair allowing specification of “Date-Time” ranges.
Properties	
Name	<i>from</i>
Type/Format	string/date-time
Description	“From” timestamp.
Name	<i>To</i>
Type/Format	string/date-time
Description	“To” timestamp.

10.1.16. TIMPrediction

Title	TIMPrediction
Description	Best prediction TIM Engine can produce based on the provided input.
Properties	

Name	<i>values</i>
Type	Object
Description	Prediction data. Object where body are pairs "date-time": "double" (value).
Example	<pre>{ "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 42.51843456, ... } }</pre>
Name	<i>LowPredictionQualityDateTimes</i>
Type	array
Items	string/date-time
Description	In the case of missing data, TIM Engine will be still able to make a prediction but will use a “dummy” model for corresponding timestamps. This variable lists all timestamps that were predicted in this way.

10.1.17. TIMAggregatedPrediction

Title	TIMAggregatedPrediction
Description	<p>“Aggregated Prediction” is a way how to combine individual predictions into one time series by 2 unique keys: specific time of prediction (i.e. 20:23:57) and predicted day value.</p> <p>Example: We predict every day at “08:00:00” and “12:00:00” from one sample ahead to the end of the following day (“intraday” + “day-ahead”). This yields 4 different aggregated predictions:</p> <p>“08:00:00” Day+0 (intraday) “08:00:00” Day+1 (day-ahead) “12:00:00” Day+0 (intraday) “12:00:00” Day+1 (day-ahead)</p>
Properties	
Name	<i>day</i>
Type/Format	integer/int32
Description	Value identifying predicted day.
Name	<i>predictionTime</i>
Type	String

Description	Time of the prediction.
Name	<i>values</i>
Type	Object
Description	Prediction data. Object where body are pairs "date-time": "double" (value).
Example	<pre>{ "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 42.51843456, ... } }</pre>

10.1.18. TIMRawPrediction

Title	TIMRawPrediction
Description	<p>“Raw Prediction” is a way how to get individual predictions for every prediction timestamp by using one unique key: specific timestamp of prediction (i.e. 2007-08-01 20:23:57).</p> <p>Example: We predict every day at “08:00:00” and “12:00:00” from one sample ahead to the end of the following day (“intraday” + “day-ahead”). This yields [2 * “number of predicted days”] different raw predictions:</p> <pre>“2007-08-01 08:00:00” “2007-08-01 12:00:00” “2007-08-02 08:00:00” “2007-08-02 12:00:00” ... “2007-10-30 08:00:00” “2007-10-30 12:00:00” ...</pre>
Properties	
Name	<i>predictionDateTime</i>
Type/Format	String/date-time
Description	Value identifying exact “date-time” of prediction.
Name	<i>values</i>
Type	Object
Description	Prediction data. Object where body are pairs "date-time": "double" (value).

Example	<pre>{ "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 42.51843456, ... } }</pre>
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10.1.19. TIMPredictionBoundariesExplicit

Title	TIMPredictionBoundariesExplicit
Description	TIM Engine object used for specification of explicit boundaries for predicted output.
Properties	
Name	<i>type</i>
Type	string
Value	"Explicit"
Description	This property is used for identification of TIMPredictionBoundaries type.
Name	<i>maxValue</i>
Type/Format	number/double
Description	Predicted output upper boundary.
Name	<i>minValue</i>
Type/Format	number/double
Description	Predicted output lower boundary.

10.1.20. TIMPredictionBoundariesNone

Title	TIMPredictionBoundariesNone
Description	TIM Engine object used for specification that no boundaries should be used for predicted output.
Properties	
Name	<i>type</i>
Type	string
Value	"None"

Description	This property is used for identification of TIMPredictionBoundaries type.
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10.1.21. TIMModelBuildingPredictionConfiguration

Title	TIMModelBuildingPredictionConfiguration
Description	TIM Engine model building/prediction configuration.
Properties	
Name	<i>domain [optional]</i>
Type	string
Enum	"Generic", "Solar"
Description	Not in use right now.
Name	<i>usage</i>
Type	TIMModelBuildingPredictionUsage (section 10.1.23)
Description	TIM usage object defining “what” we want to forecast.
Name	<i>dataNormalization [optional]</i>
Type	boolean
Description	When normalization on, predictors are scaled by mean and standard deviation. Switching off may help for data with structural changes. For difficult datasets with structural changes (change in mean of the target time-series) disabling normalization helps TIM Engine to settle in different working regimes faster which results in an improved accuracy.
Default Value	Auto
Note	If not provided, default value will be used.
Name	<i>maxModelComplexity [optional]</i>
Type/Format	integer/int32
Description	Determines maximal complexity of models and is given in integer percentage. Difficult datasets might require lower model complexity.
Note	If not provided, TIM Engine will determine optimal model complexity in automatic way.
Value	Specify explicit number for exact model complexity selection.

	Defined range: 1 – 100.
Name	<i>features [optional]</i>
Type	array
Enum Items	"MovingAverage", "DayOfWeek", "PeriodicComponents", "Intercept", "PiecewiseLinear", "TimeOffsets", "Polynomial"
Description	<ul style="list-style-type: none"> • MovingAverage - Moving Average is smoothed target variable. Smoothing factor is determined automatically. Disabling MA also helps TIM to calibrate faster in a new working regime. • DayOfWeek - TIM Engine will automatically include weekday predictor as additional predictor to model building process. • PeriodicComponents - Periodic Components are periodic functions that reflect periodic behavior of the target (i.e. daily cycles). • Intercept - Variable, which handles the mean of the target. When the signals working regime changes rapidly, it might be useful to turn it off. • PiecewiseLinear - Helps handle nonlinear dependencies between predictors and target like in the case of electricity consumption and temperature (increasing dependency during summer and decreasing dependency during winter). • TimeOffsets - Various time offsets of predictors significantly improve the accuracy as some of the predictors influence the target only after some time delay. Range of offsets searched is determined automatically for each predictor. • Polynomial - Some predictors are stronger when interacting with others. Polynomial dictionary creates all interactions between pairs of predictors.
Note	If not provided, TIM Engine will determine optimal features in automatic way.
Name	<i>timeSpecificModels [optional]</i>
Type	boolean
Description	Decides whether models should focus on respective times within the day (specific hours, quarter-hours, etc.). This way the model created for noon cannot be reused for midnight even if the data are available. Most of the time yields higher accuracy for long enough datasets with a clear daily pattern. Makes the model building faster.
Default Value	Auto
Note	If not provided, default value will be used.

Name	<i>extendedOutputConfiguration [optional]</i>
Type	TIMModelBuildingPredictionExtendedOutputConfiguration (section 10.1.22)
Description	Allows user to configure TIM Engine output returned after the model building process.
Note	If not provided, default values for each property of TIMModelBuildingPredictionExtendedOutputConfiguration will be used. See section 10.1.22 for detailed information.
Name	<i>meteoConfiguration [optional]</i>
Type	TIMMeteoModelBuildingPredictionConfiguration (section 11.3.3)
Description	For detailed information see section 11.

10.1.22. TIMModelBuildingPredictionExtendedOutputConfiguration

Title	TIMModelBuildingPredictionExtendedOutputConfiguration
Description	Extended model building/prediction configuration, which allows user to configure TIM Engine output returned after the combined model building/prediction process.
Properties	
Name	<i>returnSimpleImportances [optional]</i>
Type	boolean
Description	User can specify if “simple importances” should be returned by TIM Engine. For more details see 10.3.4 section.
Default Value	True
Note	If not provided, default value will be used.
Name	<i>returnExtendedImportances [optional]</i>
Type	boolean
Description	User can specify if “extended importances” should be returned by TIM Engine. For more details see 10.3.5 section.
Default Value	False
Note	If not provided, default value will be used.
Name	<i>predictionBoundaries [optional]</i>
Type	TIMPredictionBoundariesExplicit (section 10.1.19) TIMPredictionBoundariesNone (section 10.1.20)

Description	User can specify what type of predicted output boundaries should be applied.
Note	If not provided, TIM Engine will set automatic boundaries for predicted output.

10.1.23. TIMModelBuildingPredictionUsage

Title	TIMModelBuildingPredictionUsage
Description	Defines “what” we want to forecast.
Properties	
Name	<i>predictionTo</i>
Type	TIMRelativeTime (section 10.3.7)
Description	<p>An abstract way of denoting specific timestamps with respect to the last “target” timestamp. For this property, it refers to the “last/newest” timestamp in the set of all the possible ones.</p> <p>Example: “Day+2” refers to the “last/newest” sample in the day that is distant 2 days from the last “target” timestamp.</p>
Name	<i>modelQuality [optional]</i>
Type	array
Items	TIMModelQuality (section 10.1.5)
Description	Tells how accurate should models for forecasts in particular day be. The higher the quality is, the longer time it usually takes to build the model and accuracy should get higher, but it is not a rule.
Note	If not provided, TIM Engine will determine optimal model quality in automatic way. Automatic setting sets quality “UltraHigh” for “Day+0” and “Day+1”. The “High” quality is set for the rest of the days. If the quality is set for days, that the model is not be built for, it will be ignored. See section 10.1.5 for “Day+X” explanation.

10.2. ANOMALY DETECTION SPECIFIC

10.2.1. TIMDetectModelBuildingConfiguration

Title	TIMDetectModelBuildingConfiguration
Description	TIM Engine model building configuration.
Properties	
Name	<i>sensitivity [optional]</i>
Type/Format	number/double
Description	Sensitivity to anomalies. In other words, it is the percentage of expected anomalies in the model building data. Used to define the decision boundary.
Default Value	1
Name	<i>detectionIntervals [optional]</i>
Type	Array
Items	TIMRepeatingItem (section 10.3.8)
Description	<p>Detection intervals. Cron-like notation used to easily enumerate all the daytime instances of some repeating process. Example:</p> <p>Day: * Hour: 6-18 Minute: 0</p> <p>would denote: “Every day from 06:00:00 to 18:00:00”.</p>
Note	If not provided, all data will be used for anomaly detection.
Name	<i>normalBehaviorModellingConfiguration [optional]</i>
Type	TIMDetectNormalBehaviorModellingConfiguration (section 10.2.2)
Description	Settings used for normal behavior model.
Name	<i>abnormalBehaviorModellingConfiguration [optional]</i>
Type	TIMDetectAbnormalBehaviorModellingConfiguration (section 10.2.3)
Description	Settings used for abnormal behavior model.
Name	<i>extendedOutputConfiguration [optional]</i>

Type	TIMDetectModelBuildingExtendedOutputConfiguration (section 10.2.4)
Description	Allows user to configure TIM Engine output returned after the model building process.
Note	If not provided, default values for each property of TIMDetectModelBuildingExtendedOutputConfiguration will be used. See section 10.2.4 for detailed information.
Name	<i>meteoConfiguration [optional]</i>
Type	TIMMeteoDetectModelBuildingConfiguration (section 11.3.4)
Description	For detailed information see section 11.

10.2.2. TIMDetectNormalBehaviorModellingConfiguration

Title	TIMDetectNormalBehaviorModellingConfiguration
Description	TIM Engine normal behavior modelling configuration.
Properties	
Name	<i>dataNormalization [optional]</i>
Type	boolean
Description	When normalization on, features entering the normal behavior model are rescaled by mean and standard deviation.
Default Value	Auto
Note	If not provided, default value will be used.
Name	<i>maxModelComplexity [optional]</i>
Type/Format	integer/int32
Description	Determines maximal complexity of normal behavior model and is given in integer percentage.
Note	If not provided, TIM Engine will determine optimal model complexity in automatic way.
Value	Specify explicit number for exact model complexity selection. Defined range: 1 - 100.
Name	<i>features [optional]</i>
Type	array
Enum Items	"MovingAverage", "DayOfWeek", "PeriodicComponents",

	"Intercept", "PiecewiseLinear", "TimeOffsets", "Polynomial"
Description	<p>Features entering the normal behavior model.</p> <ul style="list-style-type: none"> • MovingAverage - Moving Average is smoothed target variable. Smoothing factor is determined automatically. Disabling MA helps normal model to calibrate faster in a new working regime. • DayOfWeek - Normal model will automatically include weekday predictor as additional predictor to model building process. • PeriodicComponents - Periodic Components are periodic functions that reflect periodic behavior of the target (i.e. daily cycles). • Intercept - Variable, which handles the mean of the target. • PiecewiseLinear - Helps handle nonlinear dependencies between predictors and target. • TimeOffsets - Various time offsets of predictors significantly improve modelling the normal behavior as some of the predictors influence the target only after some time delay. Range of offsets searched is determined automatically for each predictor. • Polynomial - Some predictors are stronger when interacting with others. Polynomial dictionary creates all interactions between pairs of predictors.
Note	If not provided, TIM Engine will determine optimal features in automatic way.
Name	<i>timeSpecificModels [optional]</i>
Type	boolean
Description	Decides whether models should focus on respective times within the day (specific hours, quarterhours, etc.). Most of the time helps to model the normal behavior.
Default Value	Auto
Note	If not provided, default value will be used.
Name	<i>useTargetOffsets [optional]</i>
Type	boolean
Description	When "useTargetOffsets" is on, normal model will contain target offsets as well.
Default Value	True
Note	If not provided, default value will be used.

10.2.3. TIMDetectAbnormalBehaviorModellingConfiguration

Title	TIMDetectAbnormalBehaviorModellingConfiguration
Description	TIM Engine anomaly modelling configuration.
Properties	
Name	<i>dataNormalization [optional]</i>
Type	boolean
Description	When normalization on, features entering the abnormal behavior model are rescaled by mean and standard deviation.
Default Value	Auto
Note	If not provided, default value will be used.
Name	<i>maxModelComplexity [optional]</i>
Type/Format	integer/int32
Description	Maximal complexity to search when building the abnormal behavior model.
Note	If not provided, TIM Engine will determine optimal model complexity in automatic way.
Value	Specify explicit number for exact model complexity selection. Defined range: 1 - 30.
Name	<i>features [optional]</i>
Type	array
Enum Items	"Residual", "Fluctuation", "FluctuationChange", "Magnitude", "MagnitudeChange", "SimpleImbalance", "SimpleImbalanceChange", "Imbalance", "Increments", "IncrementsChange", "OneSidedIncrementsChange", "Hour", "DayOfWeek", "Month"
Description	Features entering the abnormal behavior model calculated from residual output of normal behavior model

	<ul style="list-style-type: none"> • Residual – Residual output from normal behavior model. • Fluctuation – Current fluctuation of residuals. • FluctuationChange – Fluctuation change in recent past. • Magnitude – Current magnitude of residuals. • MagnitudeChange – Magnitude change in recent past. • SimpleImbalance – Current simple imbalance of residuals. • SimpleImbalanceChange – Simple imbalance change in recent past. • Imbalance – Current imbalance of residuals. • Increments – Current magnitude of residual increments. • IncrementsChange – Increments change in recent past. • OneSidedIncrementsChange – Positive vs negative increments change in recent past. • Hour – Hour of day. • DayOfWeek – Day of week. • Month – Month.
Note	If not provided, TIM Engine will determine optimal features in automatic way.

10.2.4. TIMDetectModelBuildingExtendedOutputConfiguration

Title	TIMDetectModelBuildingExtendedOutputConfiguration
Description	Extended model building configuration, which allows user to configure TIM Engine output returned after the model building process.
Properties	
Name	<i>returnAnomalyIndicator [optional]</i>
Type	boolean
Description	User can specify if “anomaly indicator” values should be returned by TIM Engine. For more details see 10.2.8 section.
Default Value	True
Note	If not provided, default value will be used.
Name	<i>returnSimpleImportances [optional]</i>
Type	boolean
Description	User can specify if “simple importances” should be returned by TIM Engine. For more details see 10.3.4 section.
Default Value	True
Note	If not provided, default value will be used.
Name	<i>returnExtendedImportances [optional]</i>

Type	boolean
Description	User can specify if “extended importances” should be returned by TIM Engine. For more details see 10.3.5 section.
Default Value	False
Note	If not provided, default value will be used.

10.2.5. TIMDetectModelRebuildingConfiguration

Title	TIMDetectModelRebuildingConfiguration
Description	TIM Engine model rebuilding configuration.
Properties	
Name	<i>rebuildType [optional]</i>
Type	string
Enum	"Basic", "NormalBehaviorModel", "AbnormalBehaviorModel", "All"
Description	<ul style="list-style-type: none"> • Basic - recalibrating the normal behavior model • NormalBehaviorModel - rebuilding the normal behavior model • AbnormalBehaviorModel - rebuilding the abnormal behavior model • All - rebuilding both normal and abnormal behavior model
Default Value	All
Note	If not provided, default value will be used.
Name	<i>extendedOutputConfiguration [optional]</i>
Type	TIMDetectModelRebuildingExtendedOutputConfiguration (section 10.2.6)
Description	Allows user to configure TIM Engine output returned after the model rebuilding process.
Note	If not provided, default values for each property of TIMDetectModelRebuildingExtendedOutputConfiguration will be used. See section 10.2.6 for detailed information.
Name	<i>meteoConfiguration [optional]</i>
Type	TIMMeteoDetectModelRebuildingConfiguration (section 11.3.5)
Description	For detailed information see section 11.

10.2.6. TIMDetectModelRebuildingExtendedOutputConfiguration

Title	TIMDetectModelRebuildingExtendedOutputConfiguration
Description	Extended model rebuilding configuration, which allows user to configure TIM Engine output returned after the model rebuilding process.
Properties	
Name	<i>returnAnomalyIndicator [optional]</i>
Type	boolean
Description	User can specify if “anomaly indicator” values should be returned by TIM Engine. For more details see 10.2.8 section.
Default Value	True
Note	If not provided, default value will be used.
Name	<i>returnSimpleImportances [optional]</i>
Type	boolean
Description	User can specify if “simple importances” should be returned by TIM Engine. For more details see 10.3.4 section.
Default Value	True
Note	If not provided, default value will be used.
Name	<i>returnExtendedImportances [optional]</i>
Type	boolean
Description	User can specify if “extended importances” should be returned by TIM Engine. For more details see 10.3.5 section.
Default Value	False
Note	If not provided, default value will be used.

10.2.7. TIMDetectDetectionConfiguration

Title	TIMDetectDetectionConfiguration
Description	TIM Engine detection configuration.
Properties	
Name	<i>meteoConfiguration [optional]</i>
Type	TIMMeteoDetectDetectionConfiguration (section 11.3.6)

Description	For detailed information see section 11.
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10.2.8. TIMDetectAnomalyIndicator

Title	TIMDetectAnomalyIndicator
Description	Anomaly indicator values produced by TIM Engine.
Properties	
Name	<i>values</i>
Type	Object
Description	Anomaly indicator data. Object where body are pairs "date-time": "double" (value).
Example	<pre>{ "values": { "2009-01-01T00:00:00Z": 0.8756, "2009-01-01T01:00:00Z": 1.5184, ... } }</pre>

10.3. GENERIC

10.3.1. TIMDataItem

Title	TIMDataItem
Description	Main data item object.
Properties	
Name	<i>uniqueName</i>
Type	string
Description	Unique name of the data item (target/predictor).
Name	<i>type</i>
Type	string
Enum	"Target", "Predictor"
Description	Flag identifying target or predictor data item.
Name	<i>updateTime [optional]</i>
Type	Array
Items	TIMRepeatingItem (section 10.3.8)
Description	<p>Time of the update. Cron-like notation used to easily enumerate all the daytime instances of some repeating process. Example:</p> <p>Day: * Hour: 5,6 Minute: 40 Second: 2-6/3</p> <p>would denote: "Every day at 05:40:02, 05:40:05, 06:40:02, and 06:40:05".</p>
Note	<p>PREDICTION – MODEL BUILDING REQUEST (see 8.1.1 section): If not provided, TIM Engine will use "usageTime" value from "usage" property of "TIMModelBuildingConfiguration" object.</p> <p>The same holds if "usageType = OneTime". Don't provide this value for this "usageType".</p> <p>PREDICTION – PREDICTION REQUEST (see 8.1.3 section): Don't provide this value for prediction request. The information has already been passed to the TIM engine in model building process.</p> <p>PREDICTION – MODEL BUILDING/PREDICTION REQUEST (see 8.1.5): Don't provide this value for combined model building/prediction</p>

	<p>request.</p> <p>ANOMALY DETECTION – MODEL BUILDING REQUEST (see 8.2.1): Don't provide this value for Target data item. It is mandatory for other predictors.</p> <p>ANOMALY DETECTION – MODEL REBUILDING REQUEST (see 8.2.3): Don't provide this value for model rebuilding request. The information has already been passed to the TIM engine in model building process.</p> <p>ANOMALY DETECTION – DETECTION REQUEST (see 8.2.5): Don't provide this value for detection request. The information has already been passed to the TIM engine in model building process.</p>
Name	<i>updateUntil [optional]</i>
Type	TIMRelativeTime (section 10.3.7)
Description	<p>An abstract way of denoting specific timestamps with respect to the given referential "updateTime". For this property, it refers to the "last/newest" timestamp in the set of all the possible ones.</p> <p>Example: "Day+2" refers to the "last/newest" sample in the day that is distant 2 days from the given "usageTime".</p>
Note	<p>PREDICTION – MODEL BUILDING REQUEST (see 8.1.1 section): If not provided, TIM Engine will use "predictionTo" value from "usage" property of "TIMModelBuildingConfiguration" object.</p> <p>PREDICTION – PREDICTION REQUEST (see 8.1.3 section): Don't provide this value for prediction request. The information has already been passed to the TIM engine in model building process.</p> <p>PREDICTION – MODEL BUILDING/PREDICTION REQUEST (see 8.1.5): Don't provide this value for combined model building/prediction request. The availability of target and predictors is determined automatically from the data provided.</p> <p>ANOMALY DETECTION – MODEL BUILDING REQUEST (see 8.2.1): Don't provide this value for Target data item. It is mandatory for other predictors.</p> <p>ANOMALY DETECTION – MODEL REBUILDING REQUEST (see 8.2.3): Don't provide this value for model rebuilding request. The information has already been passed to the TIM engine in model building process.</p> <p>ANOMALY DETECTION – DETECTION REQUEST (see 8.2.5): Don't provide this value for detection request. The information has already been passed to the TIM engine in model building process.</p>
Name	<i>values</i>

Type	Object
Description	Object where body are pairs "date-time": "double" (value).
Example	<pre>{ "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 42.51843456, ... } }</pre>

10.3.2. TIMDataOffsetItem

Title	TIMDataOffsetItem
Description	Data offset item which should be taken into account during prediction/anomaly detection phase. Represents minimal amount of needed prediction/anomaly detection data for each predictor in prediction/anomaly detection process with TIM Engine.
Properties	
Name	<i>uniqueName</i>
Type	string
Description	Target/Predictor's name.
Name	<i>from</i>
Type	TIMRelativeTime (section 10.3.7)
Description	From value.

10.3.3. TIMPredictorsImportance

Title	TIMPredictorsImportance
Description	Provides importances for individual predictors in percentage.
Properties	
Name	<i>simpleImportances</i>
Type	array
Items	TIMImportanceSimpleItem (section 10.3.4)
Description	Provides simple importances for individual predictors. Together it is 100%.
Example	{

	<pre> "simpleImportances": [{ "predictorName": "Target_name", "importance": 83.1, }] } </pre>
Note	<p>Included in response by default: YES.</p> <p>PREDICTION: It can be configured through “returnSimpleImportances” property in “extendedOutputConfiguration” of “TIMModelBuildingConfiguration” object.</p> <p>ANOMALY DETECTION: It can be configured through “returnSimpleImportances” property in “extendedOutputConfiguration” of “TIMDetectModelBuildingConfiguration” and “TIMDetectModelRebuildingConfiguration” object.</p>
Name	<i>extendedImportances</i>
Type	array
Items	TIMImportanceExtendedItem (section 10.3.5)
Description	Provides extended importances not only for individual predictors but for every term in each equation. Together it is 100%.
Example	<pre> { "extendedImportances": [{ "termName": "Target_Name(t - 26)", "importance": 36.2, "time": 08:00:00, "type": "TargetAndTargetTransformation" }], } </pre>
Note	<p>Included in response by default: NO.</p> <p>PREDICTION: It can be configured through “returnExtendedImportances” property in “extendedOutputConfiguration” of “TIMModelBuildingConfiguration” object.</p> <p>ANOMALY DETECTION: It can be configured through “returnExtendedImportances” property in “extendedOutputConfiguration” of “TIMDetectModelBuildingConfiguration” and “TIMDetectModelRebuildingConfiguration” object.</p>

10.3.4. TIMImportanceSimpleItem

Title	TIMImportanceSimpleItem
Description	Provides simple importances for individual predictors.
Properties	
Name	<i>predictorName</i>
Type	string
Description	Target/Predictor's name.
Name	<i>importance</i>
Type/Format	number/double
Description	Target/Predictor's importance in percentage.

10.3.5. TIMImportanceExtendedItem

Title	TIMImportanceExtendedItem
Description	Provides extended importances not only for individual predictors but for every term in each equation.
Properties	
Name	<i>termName</i>
Type	string
Description	Term's name.
Name	<i>importance</i>
Type/Format	number/double
Description	Term's importance in percentage.
Name	<i>time</i>
Type	string
Description	Equation time.
Name	<i>type</i>
Type	string
Enum	"TargetAndTargetTransformation", "Predictor", "Calendar",

	"Interaction"
Description	Type of the term in equation.

10.3.6. TIMResultExplanationItem

Title	TIMResultExplanationItem
Description	Provides explanation for final model building/prediction status.
Properties	
Name	<i>Index</i>
Type/Format	integer/int32
Description	Index of message.
Name	<i>Message</i>
Type	String
Description	Explanation.

10.3.7. TIMRelativeTime

Title	TIMRelativeTime
Description	<p>An abstract way of denoting specific timestamps with respect to the given referential time/date-time.</p> <p>Example 1: "Day+2" with respect to "2008-01-01 22:07:04" refers to all timestamps in the day that is distant 2 days from the given referential timestamp - it means all timestamps between "2008-01-03 00:00:00" and "2008-01-03 23:59:59".</p> <p>Example 2: "Hour-3" with respect to "2008-01-01 22:07:04" refers to all timestamps in the hour that is distant -3 hours from the given referential timestamp - it means all timestamps between "2008-01-01 19:00:00" and "2008-01-01 19:59:59".</p>
Properties	
Name	<i>baseUnit</i>
Type	String
Description	Time unit in which the relative distance is counted.
Enum	"Day", "Hour", "QuarterHour", "Sample"
Name	<i>offset</i>

Type/Format	integer/int32
Description	Offset value.

10.3.8. TIMRepeatingItem

Title	TIMRepeatingItem
Description	<p>Cron-like notation used to easily enumerate all the daytime instances of some repeating process. Example:</p> <p>Day: * Hour: 5,6 Minute: 40 Second: 2-6/3</p> <p>would denote: "Every day at 05:40:02, 05:40:05, 06:40:02, and 06:40:05".</p>
Properties	
Name	<i>type</i>
Type	string
Description	Repeating type.
Enum	"Day", "Hour", "Minute", "Second"
Name	<i>value</i>
Type	string
Description	<p>Possibilities:</p> <ul style="list-style-type: none"> • Number: 7 • Set of numbers separated with ",": 59,58,21 • Step range denoted with "-" and "/": 5-10/2 equals 5,7,9 • All possible values for given type: *

10.3.9. TIMEvent

Title	TIMEvent
Description	TIM Engine event, which can hold different type of information. Based on events, the whole computing process can be tracked.
Properties	
Name	<i>dateTime</i>
Type/Format	string/date-time

Description	Date-time information when the event happened.
Name	<i>message</i>
Type	string
Description	Event message.
Name	<i>progress</i>
Type/Format	number/double
Description	Holds only for "Progress" <i>eventType</i> .
Name	<i>eventType</i>
Type	string
Enum	"ModelBuildingStart", "PredictionStart", "Submit", "Error", "Progress", "Accuracy", "LogMessage", "DataOffset", "Model", "ResultEquations", "PredictorsImportance", "Prediction", "Finished", "MeteoData", "MeteoDataDownloadStarted", "MeteoDataDownloadProgress", "MeteoDataDownloadFinished", "ResultExplanations", "DataDifficulty", "Detection", "DetectionStart", "ModelRebuildingStart", "ModelBuildingPredictionStart"
Description	Event type.

10.3.10. TIMRequestError

Title	TIMRequestError
Description	Request error object.
Properties	
Name	<i>description</i>

Type	string
Description	Request error description.
Name	<i>status</i>
Type	string
Description	Request error status.
Enum	"InvalidAuthentication", "MaximumConcurrentRequestsExceeded", "MaximumSizeOfRequestExceeded", "InvalidInputData", "Other"

11. Meteo Predictors Extension

User provided predictors for model building/prediction/anomaly detection process can be automatically extended with meteorological predictors (based on the TIM License).

- *"TIMModelBuildingConfiguration"* (section 10.1.1) can be extended with *"TIMMeteoModelBuildingConfiguration"* (section 11.3.1).
- *"TIMPredictionConfiguration"* (section 10.1.6) can be extended with *"TIMMeteoPredictionConfiguration"* (section 11.3.2).
- *"TIMModelBuildingPredictionConfiguration"* (section 10.1.21) can be extended with *"TIMMeteoModelBuildingPredictionConfiguration"* (section 11.3.3).
- *"TIMDetectModelBuildingConfiguration"* (section 10.2.1) can be extended with *"TIMMeteoDetectModelBuildingConfiguration"* (section 11.3.4).
- *"TIMDetectModelRebuildingConfiguration"* (section 10.2.5) can be extended with *"TIMMeteoDetectModelRebuildingConfiguration"* (section 11.3.5).
- *"TIMDetectDetectionConfiguration"* (section 10.2.7) can be extended with *"TIMMeteoDetectDetectionConfiguration"* (section 11.3.6).

Important notes:

- Specified values for "latitude" and "longitude" properties must be in decimal degrees (see *"TIMMeteoLocationConfiguration"* (section 11.3.7)).
- [PREDICTION RELATED] - Meteorological predictors are valid for prediction horizon not higher than "1 day" – typical day-ahead forecasting scenario (it is abstract value – in real use case it is value of *"predictionTo"* property set to i.e. "D+1" (Day plus one) (see *"TIMModelBuildingUsageRepeating"* (section 10.1.3) or *"TIMModelBuildingUsageOneTime"* (section 10.1.2)) in *"TIMModelBuildingConfiguration"* (section 10.1.1)). In the case that prediction horizon is higher than "1 day" and meteorological predictors are specified, they will be automatically excluded from model-building/prediction process.
- "Wind direction" (*"M_WD"* (section 11.3.8)) meteorological predictor cannot be used for data sampling rate higher than 60 minutes. If the data sampling rate is higher than 60 minutes and "Wind direction" meteorological predictor is specified, than it will be automatically excluded from model-building/prediction process.

11.1. PREDICTION

11.1.1. Model building request modification

Title	Model Building Request
URL	/api/prediction/build-model
Method	POST
Description	Example shows configuration of additional meteo predictors for specific GPS coordinates.
Note	Use of “meteoConfiguration” property is optional. If not provided, no meteorological data will be included to model building process.
Data Params	TIMModelBuildingRequest (section 9.1.1)
Example 1	<pre>{ "configuration": { "domain": "Generic", ... "meteoConfiguration": { "meteoLocations": [{ "latitude": 52.367005, "longitude": 4.916382, "meteoPredictors": ["M_GHI", "M_TEMP"] }], "returnUsedMeteoData": true } }, "data": [{ "uniqueName": "Load", "type": "Target", "updateTime": [{"type": "Day", "value": "*"}, {"type": "Hour", "value": "7"}, {"type": "Minute", "value": "0"}], "updateUntil": {"baseUnit": "Sample", "offset": 0}, "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 38.74110756, ... } }] }</pre>
Example 2	Fully functional sample requests bodies can be found in “attachments_rest” zip file in “PREDICTION_Samples” directory.
Properties	
Name	<i>meteoConfiguration</i>



Type	TIMMeteoModelBuildingConfiguration (section 11.3.1)
Description	TIM Engine meteorological configuration for model building process

11.1.2. Model building status response extension

Title	Model building Status Response
Description	Example shows modification of model building status response extended with used meteorological data.
Response	TIMModelBuildingStatusResponse (section 9.1.3)
Example	<pre>{ "requestUUID": "f0d467be-2222-4c12-84db-8fdb9419ab91", "status": "Finished", "events": [...], "dataOffsets": [...], "progress": 100, "dataDifficulty": 49, "model": "abFrasLmvxYz...", "usedMeteoData": [{ "uniqueName": "M_GHI_1", "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": 0, "2009-01-01T01:00:00.000Z": 0, ... } }, { "uniqueName": "M_TEMP_1", "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": -8, "2009-01-01T01:00:00.000Z": -7.8, ... } }], "engineResult": "Successful", }</pre>
Properties	
Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	Meteorological data used for model building process.

11.1.3. Prediction request modification

Title	Prediction Request
URL	/api/prediction/ predict/
Method	POST
Description	Example shows additional meteo configuration for prediction process
Note	Use of “meteoConfiguration” property is optional.
Data Params	TIMPredictionRequest (section 9.1.4)
Example 1	<pre>{ "model": "uec5NlPjVCS1WKoEs...", "configuration": { "meteoConfiguration": { "returnUsedMeteoData": true } }, "data": [{ "uniqueName": "Load", "type": "Target", "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 38.74110756, ... } }] }</pre>
Example 2	Fully functional sample requests bodies can be found in “attachments_rest” zip file in “PREDICTION_Samples” directory.
Properties	
Name	<i>meteoConfiguration</i>
Type	TIMMeteoPredictionConfiguration (section 11.3.2)
Description	TIM Engine meteorological configuration for prediction process.

11.1.4. Prediction status response extension

Title	Prediction Status Response
Description	Example shows modification of prediction status response extended with used meteorological data.
Response	TIMPredictionStatusResponse (section 9.1.6)
Example	<pre>{ "requestUUID": "bacac46f-88d7-44bd-9489-6beeb47aef40",</pre>

	<pre> "status": "Finished", "events": [...], "progress": 100, "engineResult": "Successful", "prediction": { "values": { "2019-03-14T10:00:00.000Z": 52.5273, "2019-03-14T11:00:00.000Z": 45.3786, "2019-03-14T12:00:00.000Z": 36.4541, ... } }, "usedMeteoData": [{ "uniqueName": "M_GHI_1", "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": 0, "2009-01-01T01:00:00.000Z": 0, ... } }, { "uniqueName": "M_TEMP_1", "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": -8, "2009-01-01T01:00:00.000Z": -7.8, ... } }] </pre>
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Properties

Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	Meteorological data used for prediction process.

11.1.5. Model building/prediction request modification

Title	Model Building/Prediction Request
URL	/api/prediction/build-model-predict
Method	POST
Description	Example shows configuration of additional meteo predictors for specific GPS coordinates.



Note	Use of “meteoConfiguration” property is optional. If not provided, no meteorological data will be included to model building process.
Data Params	TIMModelBuildingPredictionRequest (section 9.1.7)
Example 1	<pre> { "configuration": { "domain": "Generic", ... "meteoConfiguration": { "meteoLocations": [{ "latitude": 52.367005, "longitude": 4.916382, "meteoPredictors": ["M_GHI", "M_TEMP"] }], "returnUsedMeteoData": true } }, "data": [{ "uniqueName": "Load", "type": "Target", "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 38.74110756, ... } }] } </pre>
Example 2	Fully functional sample requests bodies can be found in “attachments_rest” zip file in “PREDICTION_Samples” directory.
Properties	
Name	<i>meteoConfiguration</i>
Type	TIMMeteoModelBuildingPredictionConfiguration (section 11.3.3)
Description	TIM Engine meteorological configuration for model building/prediction process.

11.1.6. Model building/prediction status response extension

Title	Model Building/Prediction Status Response
Description	Example shows modification of combined model building/prediction status response extended with used meteorological data.
Response	TIMModelBuildingPredictionStatusResponse (section 9.1.9)
Example	<pre> { "requestUUID": "f0d467be-2222-4c12-84db-8fdb9419ab91", "status": "Finished", </pre>

	<pre> "events": [...], "progress": 100, "dataDifficulty": 49, "usedMeteoData": [{ "uniqueName": "M_GHI_1", "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": 0, "2009-01-01T01:00:00.000Z": 0, ... } }, { "uniqueName": "M_TEMP_1", "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": -8, "2009-01-01T01:00:00.000Z": -7.8, ... } }], "engineResult": "Successful", } </pre>
Properties	
Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	Meteorological data used for model building/prediction process.

11.2. ANOMALY DETECTION

11.2.1. Model building request modification

Title	Model Building Request
URL	/api/detection/build-model
Method	POST
Description	Example shows configuration of additional meteo predictors for specific GPS coordinates.
Note	Use of “meteoConfiguration” property is optional. If not provided, no meteorological data will be included to model building process.
Data Params	TIMDetectModelBuildingRequest (section 9.2.1)
Example 1	<pre>{ "configuration": { ... "meteoConfiguration": { "meteoLocations": [{ "latitude": 52.367005, "longitude": 4.916382, "meteoPredictors": ["M_GHI", "M_TEMP"] }], "returnUsedMeteoData": true } }, "data": [{ "uniqueName": "ProducedEnergy", "type": "Target", "values": { "2009-01-01T00:00:00Z": 15.58645423, "2009-01-01T01:00:00Z": 16.74110756, ... } }] }</pre>
Example 2	Fully functional sample requests bodies can be found in “attachments_rest” zip file in “DETECTION_Samples” directory.
Properties	
Name	<i>meteoConfiguration</i>
Type	TIMMeteoDetectModelBuildingConfiguration (section 11.3.4)
Description	TIM Engine meteorological configuration for model building process



11.2.2. Model building status response extension

Title	Model building Status Response
Description	Example shows modification of model building status response extended with used meteorological data.
Response	TIMDetectModelBuildingStatusResponse (section 9.2.3)
Example	<pre> { "requestUUID": "f0d467be-2222-4c12-84db-8fdb9419ab91", "status": "Finished", "events": [...], "dataOffsets": [...], "progress": 100, "model": "abFrasLmvxYz...", "usedMeteoData": [{ "uniqueName": "M_GHI_1", "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": 0, "2009-01-01T01:00:00.000Z": 0, ... } }, { "uniqueName": "M_TEMP_1", "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": -8, "2009-01-01T01:00:00.000Z": -7.8, ... } }], "engineResult": "Successful", }</pre>
Properties	
Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	Meteorological data used for model building process.

11.2.3. Model rebuilding request modification

Title	Model Rebuilding Request
URL	/api/detection/ rebuild-model/
Method	POST
Description	Example shows additional meteo configuration for model rebuilding process.
Note	Use of “meteoConfiguration” property is optional.
Data Params	TIMDetectModelRebuildingRequest (section 9.2.4)
Example 1	<pre>{ "model": "uec5NlPjVCS1WKoEs...", "configuration": { "meteoConfiguration": { "returnUsedMeteoData": true } }, "data": [{ "uniqueName": "ProducedEnergy", "type": "Target", "values": { "2009-01-01T00:00:00Z": 43.544788, "2009-01-01T01:00:00Z": 45.741107, ... } }] }</pre>
Example 2	Fully functional sample requests bodies can be found in “attachments_rest” zip file in “DETECTION_Samples” directory.
Properties	
Name	<i>meteoConfiguration</i>
Type	TIMMeteoDetectModelRebuildingConfiguration (section 11.3.5)
Description	TIM Engine meteorological configuration for model rebuilding process

11.2.4. Model rebuilding status response extension

Title	Model Rebuilding Status Response
Description	Example shows modification of model rebuilding status response extended with used meteorological data.
Response	TIMDetectModelRebuildingStatusResponse (section 9.2.6)

Example	<pre> { "requestUUID": "f0d467be-2222-4c12-84db-8fdb9419ab91", "status": "Finished", "events": [...], "dataOffsets": [...], "progress": 100, "model": "abFrasLmvxYz...", "usedMeteoData": [{ "uniqueName": "M_GHI_1", "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": 0, "2009-01-01T01:00:00.000Z": 0, ... } }, { "uniqueName": "M_TEMP_1", "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": -8, "2009-01-01T01:00:00.000Z": -7.8, ... } }], "engineResult": "Successful", } </pre>
Properties	
Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	Meteorological data used for model rebuilding process.

11.2.5. Detection request modification

Title	Model Detection Request
URL	/api/detection/ detect/
Method	POST
Description	Example shows additional meteo configuration for detection process
Note	Use of “meteoConfiguration” property is optional.
Data Params	TIMDetectDetectionRequest (section 9.2.7)

Example 1	<pre>{ "model": "uec5NlPjVCS1WKoEs...", "configuration": { "meteoConfiguration": { "returnUsedMeteoData": true } }, "data": [{ "uniqueName": "ProducedEnergy", "type": "Target", "values": { "2009-01-01T00:00:00Z": 43.544788, "2009-01-01T01:00:00Z": 45.741107, ... } }] }</pre>
Example 2	Fully functional sample requests bodies can be found in “attachments_rest” zip file in “DETECTION_Samples” directory.
Properties	
Name	<i>meteoConfiguration</i>
Type	TIMMeteoDetectDetectionConfiguration (section 11.3.6)
Description	TIM Engine meteorological configuration for detection process.

11.2.6. Detection status response extension

Title	Detection Status Response
Description	Example shows modification of detection status response extended with used meteorological data.
Response	TIMDetectDetectionStatusResponse (section 9.2.9)
Example	<pre>{ "requestUUID": "bacac46f-88d7-44bd-9489-6beeb47aef40", "status": "Finished", "events": [...], "progress": 100, "engineResult": "Successful", "anomalyIndicator": { "values": { "2019-03-14T10:00:00.000Z": 1.85645, "2019-03-14T11:00:00.000Z": 0.85455, "2019-03-14T12:00:00.000Z": 2.45414, ... } }, "usedMeteoData": [{ "uniqueName": "M_GHI_1", </pre>

	<pre> "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": 0, "2009-01-01T01:00:00.000Z": 0, ... } }, { "uniqueName": "M_TEMP_1", "latitude": 50.400387, "longitude": 13.47377, "values": { "2009-01-01T00:00:00.000Z": -8, "2009-01-01T01:00:00.000Z": -7.8, ... } }] } </pre>
Properties	
Name	<i>usedMeteoData</i>
Type	array
Items	TIMMeteoDataItem (section 11.3.9)
Description	Meteorological data used for prediction process.

11.3. METEO OBJECTS DEFINITIONS

11.3.1. TIMMeteoModelBuildingConfiguration

Title	TIMMeteoModelBuildingConfiguration
Description	TIM Engine meteorological configuration for model building process (Prediction).
Properties	
Name	<i>meteoLocations</i>
Type	array
Items	TIMMeteoLocationConfiguration (section 11.3.7)
Description	Specification of individual meteo locations with requested meteo predictors for each GPS coordinate.
Name	<i>returnUsedMeteoData [optional]</i>
Type	boolean
Description	If set to true, then used meteo data will be returned in "TIMModelBuildingStatusResponse" (section 9.1.3).
Default Value	False
Note	If not provided in TIMMeteoModelBuildingConfiguration, default value will be used.

11.3.2. TIMMeteoPredictionConfiguration

Title	TIMMeteoPredictionConfiguration
Description	TIM Engine meteorological configuration for prediction process (Prediction).
Properties	
Name	<i>returnUsedMeteoData [optional]</i>
Type	boolean
Description	If set to true, then used meteo data will be returned in "TIMPredictionStatusResponse" (section 9.1.6).
Default Value	False
Note	If not provided in TIMMeteoPredictionConfiguration, default value will be used.

11.3.3. TIMMeteoModelBuildingPredictionConfiguration

Title	TIMMeteoModelBuildingPredictionConfiguration
Description	TIM Engine meteorological configuration for model building/prediction process (Prediction).
Properties	
Name	<i>meteoLocations</i>
Type	array
Items	TIMMeteoLocationConfiguration (section 11.3.7)
Description	Specification of individual meteo locations with requested meteo predictors for each GPS coordinate.
Name	<i>returnUsedMeteoData [optional]</i>
Type	boolean
Description	If set to true, then used meteo data will be returned in "TIMModelBuildingPredictionStatusResponse" (section 9.1.9).
Default Value	False
Note	If not provided in TIMMeteoModelBuildingPredictionConfiguration, default value will be used.

11.3.4. TIMMeteoDetectModelBuildingConfiguration

Title	TIMMeteoDetectModelBuildingConfiguration
Description	TIM Engine meteorological configuration for model building process (Anomaly Detection).
Properties	
Name	<i>meteoLocations</i>
Type	array
Items	TIMMeteoLocationConfiguration (section 11.3.7)
Description	Specification of individual meteo locations with requested meteo predictors for each GPS coordinate.
Name	<i>returnUsedMeteoData [optional]</i>
Type	boolean

Description	If set to true, then used meteo data will be returned in “TIMDetectModelBuildingStatusResponse” (section 9.2.3).
Default Value	False
Note	If not provided in TIMMeteoDetectModelBuildingConfiguration, default value will be used.

11.3.5. TIMMeteoDetectModelRebuildingConfiguration

Title	TIMMeteoDetectModelRebuildingConfiguration
Description	TIM Engine meteorological configuration for model rebuilding process (Anomaly Detection).
Properties	
Name	<i>returnUsedMeteoData [optional]</i>
Type	boolean
Description	If set to true, then used meteo data will be returned in “TIMDetectModelRebuildingStatusResponse” (section 9.2.6).
Default Value	False
Note	If not provided in TIMMeteoDetectModelRebuildingConfiguration, default value will be used.

11.3.6. TIMMeteoDetectDetectionConfiguration

Title	TIMMeteoDetectDetectionConfiguration
Description	TIM Engine meteorological configuration for detection process (Anomaly Detection).
Properties	
Name	<i>returnUsedMeteoData [optional]</i>
Type	boolean
Description	If set to true, then used meteo data will be returned in “TIMDetectDetectionStatusResponse” (section 9.2.9).
Default Value	False
Note	If not provided in TIMMeteoDetectDetectionConfiguration, default value will be used.

11.3.7. TIMMeteoLocationConfiguration

Title	TIMMeteoLocationConfiguration
Description	Meteorological model building configuration for one location.
Properties	
Name	<i>Latitude</i>
Type/Format	number/double
Description	Latitude.
Unit	decimal degrees
Name	<i>Longitude</i>
Type/Format	number/double
Description	Longitude.
Unit	decimal degrees
Name	meteoPredictors
Type	array
Items	TIMMeteoPredictors (section 11.3.8)
Description	Selection of individual predictors for this location.

11.3.8. TIMMeteoPredictors

Title	TIMMeteoPredictors
Description	Individual meteorological predictors.
Enum	
Name	<i>M_GHI</i>
Description	Global horizontal radiation.
Unit	<p>“Data Sampling Rate” < 60 min → W/m2 “Data Sampling Rate” >= 60 min && “Data Sampling Rate” < 1440 min → Wh/m2 “Data Sampling Rate” >= 1440 min → kWh/m2</p> <p>Note: “Data Sampling Rate (min)” = Number of minutes between two data items. 60 for data item every hour.</p>
Name	<i>M_DIF</i>

Description	Diffuse horizontal radiation.
Unit	"Data Sampling Rate" < 60 min → W/m ² "Data Sampling Rate" ≥ 60 min && "Data Sampling Rate" < 1440 min → Wh/m ² "Data Sampling Rate" ≥ 1440 min → kWh/m ² Note: "Data Sampling Rate (min)" = Number of minutes between two data items. 60 for data item every hour.
Name	M_DNI
Description	Direct normal radiation.
Unit	"Data Sampling Rate" < 60 min → W/m ² "Data Sampling Rate" ≥ 60 min && "Data Sampling Rate" < 1440 min → Wh/m ² "Data Sampling Rate" ≥ 1440 min → kWh/m ² Note: "Data Sampling Rate (min)" = Number of minutes between two data items. 60 for data item every hour.
Name	M_TEMP
Description	Air temperature at 2 m.
Unit	degrees Celsius
Name	M_WS
Description	Wind speed at 10 m.
Unit	(m/s)
Name	M_WD
Description	Wind direction, true north-based azimuth.
Unit	degrees
Note	Do not request this variable if data sampling rate is higher than 60 (minutes).
Name	M_RH
Description	Relative humidity.
Unit	%
Name	M_SA
Description	Sun altitude (elevation) angle.
Unit	degrees
Name	M_SE

Description	Sun azimuth angle.
Unit	degrees
Name	M_AP
Description	Atmospheric pressure.
Unit	hPa
Name	M_PVYIELD
Description	Output from PV system.
Unit	"Data Sampling Rate" < 60 min → kW "Data Sampling Rate" ≥ 60 min → kWh Note: "Data Sampling Rate (min)" = Number of minutes between two data items. 60 for data item every hour.

11.3.9. TIMMeteoDataItem

Title	TIMMeteoDataItem
Description	Data item object which serves for returning used meteorological predictors.
Properties	
Name	<i>uniqueName</i>
Type	string
Description	Unique name of the data item (meteorological predictor).
Name	<i>latitude</i>
Type/Format	number/double
Description	Latitude.
Unit	decimal degrees
Name	<i>longitude</i>
Type/Format	number/double
Description	Longitude.
Unit	decimal degrees
Name	<i>values</i>
Type	Object

Description	Object where body are pairs "date-time": "double" (value).
Example	<pre>{ "values": { "2009-01-01T00:00:00Z": 38.74110756, "2009-01-01T01:00:00Z": 42.51843456, ... } }</pre>

11.3.10. TIMMeteoSolarPowerPlantConfiguration

Title	TIMMeteoSolarPowerPlantConfiguration
Description	TIM Engine meteorological configuration for solar power plant.
Properties	
Name	<i>installationType</i>
Type	string
Enum	"FreeStanding", "RoofMounted", "BuildingIntegrated"
Description	Installation type of PV system. This property of the PV system helps to estimate how modules are ventilated. For sloped roof with PV modules on rails tilted at the same angle as the roof choose "RoofMounted" value. For PV modules incorporated into building facade choose "BuildingIntegrated" value. This option is considered as the worst ventilated. As the best ventilated option is considered free standing installation. This typically means stand-alone installation on tilted racks anchored into the ground. Also choose this option if a PV system is installed on a flat roof (similar to stand-alone installation). The string value is in this case "FreeStanding".
Default Value	FreeStanding
Name	<i>installedPower</i>
Type/Format	number/double
Description	Total installed power of the PV system in kilowatts-peak (kWp). The total PV system rating consists of a summation of the panel ratings measured in STC.
Default Value	1000.0
Name	<i>moduleType</i>
Type	string
Enum	"MT_CSI", "MT_CIS", "MT_ASI", "MT_CDTE"

Description	Materials used in PV modules. <ul style="list-style-type: none"> • MT_CSI - Crystalline silicon • MT_CIS - Copper indium selenide • MT_ASI - Amorphous silicon • MT_CDTE - Cadmium telluride
Default Value	MT_CSI
Example 1	<pre>{ "meteoConfiguration": { "meteoLocations": [{ "latitude": 52.367005, "longitude": 4.916382, "meteoPredictors": ["M_GHI", "M_TEMP"] }], "returnUsedMeteoData": false } }</pre>
Example 2	Fully functional sample requests bodies can be found in “attachments_rest” zip file in “PREDICTION_Samples” and “DETECTION_Samples” directory.

12. Conventions

- Status – HTTP status code of response.
- All requests and responses are in JSON format.
- All request parameters are mandatory unless explicitly marked as [optional].

13. Engine Messages

13.1. License

- License file not found.
- Invalid license key.
- Invalid hardware ID.
- License expired.

13.2. Configuration

- Model complexity must be an integer between 0 and 100.
- At least one feature must be set.
- Invalid “usage” – nothing to predict.
- Invalid sensitivity.

13.3. Predictors

- No predictors for model building.
- Predictor name "####" is not unique!
- Predictor name is empty string!
- Target is not available!
- Multiple target variables!
- All predictor info must have the same sampling rate.
- Insufficient amount of data. Minimal length of one data block is "####" samples.

13.4. Generic

- Parsing model failed.

13.5. Warnings

- Using weak model for some timestamp, add more data according to data offsets requirements.
- Model complexity is influenced by small amount of data.
- Predictor “####” has some values higher/lower by ####2% than on the model building. It might affect the accuracy.